# OPERATOR'S AND OPERATIONAL

# MAINTENANCE MANUAL

## SWEEP SIGNAL GENERATOR

## VS SERIES

This manual pertains to a

Model _____

Serial No. _____

TEXSCAN CORPORATION
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# CHAPTER 1. INTRODUCTION

## Section I. GENERAL

### 1-1. Scope.

This manual covers instrument description, technical characteristics, components, unpacking and preparation for use, operating instructions, theory of operation, detailed circuit description, trouble-shooting, adjustment, and calibration.

### 1-2. Reporting of Equipment Manual Improvements.

The direct reporting of errors, omissions, and recommendations for improving this equipment manual by the individual user is welcomed and encouraged.

## Section II. DESCRIPTION AND DATA

### 1-3. Purpose and Use.

The VS series of sweep generators provide a source of RF energy in the microwave spectrum. Continuous wave signals as well as signals representing a sweep of frequency are available. An internal system permits the use of up to eight (8) plug-in markers, for precision identification of frequency. A broad choice of sweep rates and sweep widths are offered.

The instrument finds its most general application in the examination of components and devices whose characteristics may be presented as a display of amplitude vs. frequency, using the panoramic technique.

### 1-4. Technical Characteristics, Model VS-80.

| | | |
|---|---|---|
| a. | Center Frequency Range | Continuously variable from 1 MHz to 1000 MHz. Sweeps up to 1200 MHz at maximum sweep width. |
| b. | Range - Low Band | 1 MHz to 300 MHz CW |
| | High Band | 300 MHz to 1000 MHz CW |
| c. | Sweep width - Low Band | 50 KHz to 300 MHz |
| | High Band | Up to 40% of center frequency at 1000 MHz. |

| | | |
|---|---|---|
| d. | Output Voltage | 0.5 V RMS into a 50 ohm load. |
| e. | Output Voltage Variation - Low Band | ± 0.25 DB at maximum sweep width |
| | High Band | ± 0.50 DB at maximum sweep width |
| f. | Source Impedance | Operates into a 50 ohm load. |
| g. | Sweep Linearity | Within 5% of sweep width. |
| h. | Sweep Rate - Line Mode | Power line frequency |
| | Variable Mode | 5 Hz to 60 Hz |
| | Variable Mode | 0.05 Hz to 5 Hz |
| | Manual Mode | Controlled manually |
| | External Mode | External signal rate |
| i. | Horizontal Output Voltage | 10 V (minimum) peak to peak triangular waveform. |
| j. | Frequency Dial Accuracy | Within 1% of the output frequency or 5 MHz, whichever is greater. |
| k. | Attenuation | 0 to 70 DB in 10 DB steps, plus an additional continuously variable 10 DB control of RF power. |
| l. | Input Power | 115 or 230 V, 50-60 Hz, 1 Ø, 15 watts |
| m. | Dimensions | 6-7/8" High<br>17" Wide<br>16" Deep |
| n. | Weight | Approximately 23 pounds |

1-5. Components.

The Model VS-80 is identified by Final Assembly A200-315. The sub-assemblies which comprise this final assembly are as follows:

| ITEM | PART NO. | QTY. | DESCRIPTION |
|---|---|---|---|
| 1 | A204-422 | 1 | Rear Panel Assembly |
| 2 | A200-005-01 | 2 | Termination for Sweep Sample |
| 3 | A204-051 | 1 | Backing Panel Assembly |
| 4 | A200-030-02 | 1 | Coaxial Switch Assembly |
| 5 | B200-200-01 | 1 | Attenuator Assembly |
| 7 | A204-420 | 1 | Chassis Assembly |
| 8 | A204-428 | 1 | Printed Wiring Board - Power and Control |

| ITEM | PART NO. | QTY. | DESCRIPTION |
|---|---|---|---|
| 9 | A204-421 | 1 | Marker Preamplifier Assembly |
| 10 | A204-055 | 1 | Marker-Mixer-Monitor Assembly |
| 11 | A204-250 | 1 | Coaxial Cable Set |
| 12 | A204-053 | 1 | Variable Frequency Oscillator Assembly |
| 13 | A204-052 | 1 | Fixed Frequency Oscillator Assembly |
| 14 | A204-214 | 1 | Filter Assembly for Fixed Oscillator |
| 16 | A204-446 | 1 | Video Amplifier Assembly |
| 18 | A204-426 | 1 | Cabinet Assembly |
| 19 | A204-437 | 1 | Harness Assembly |

The above listing has been verified through ECN 629, dated 12-16-69.

1-6. Options for VS-80.

The following options are available at the time the instrument is ordered:

| ITEM | PART NO. | QTY. | DESCRIPTION | OPTION |
|---|---|---|---|---|
| 21 | A204-140 | 1 | 1 KHz Amplitude Modulator Kit | -1 |
| 22 | A204-450 | 1 | 0 - 10 DB Attenuator Kit | -A |
| 23 | A204-451 | 1 | Pen Lift Kit | -P |
| 24 | A204-452 | 1 | RF Modulation Marker Kit | -T |
| 25 | A204-453 | 1 | External Modulation Kit | -S |
| 26 | A204-454 | 1 | External Trigger Kit | -- |

Provision has been made for the use of up to eight single frequency (SM) or harmonic (HM) markers. These markers are of the plug-in type, and may be installed at any time. Accordingly, these markers are not classed as an option, but as an accessory. Refer to Texscan catalog #68 for a description of the accessories available for the VS-80.

1-7. Additional Equipment Required.

The additional equipment required will depend on the application which the instrument is to serve. However, for use in a utility category, the following accessories are recommended.

RF Detector . . . . . Texscan CD-51 External Monitor ..Texscan EM-61

| | | | |
|---|---|---|---|
| Cable Set . . . . | Texscan 501 | Oscilloscope . . . | Tektronix 503 |
| Markers . . . . . | Texscan HM-.1 | Markers, 1 MHz . . | Texscan HM- 1 |
| Markers, 10 MHz . . | Texscan HM-10 | Markers, 50 MHz. . | Texscan HM-50 |

1-8. Description of Instrument.

A front view of a typical instrument in the VS series is shown in Figure 1-8. The same functions are provided on all VS units, with a slight rearrangement of controls.

The legends engraved on the panel identify the function of each control. The numbers inscribed within the balloons identify controls which are discussed in detail in the Section devoted to operator's controls.

# CHAPTER 2. INSTALLATION

## Section I. SERVICE UPON RECEIPT OF EQUIPMENT

### 2-1. Unpacking.

Figure 2-1 is an illustration of the standard commercial package used with the VS series of instruments. The unit is suspended within a corrugated container by means of four polyfoam plastic bolsters. To remove the instrument from its container, open the top, and lift the unit out.

### 2-2. Checking Unpacked Equipment.

Inspect the equipment for damage that may have occurred during shipment. If the equipment has been damaged, notify the carrier at once.

Check to see that the equipment is complete as listed on the packing slip. Report any discrepancies of a concealed nature to the vendor. If a complete package is missing, report this to the carrier.

Check the serial number of the instrument against the packing slip, and also the instruction manual. Report any discrepancy to the vendor.

It is suggested that the container and packing material be retained, should it become necessary to return the instrument for repair or recalibration.

## Section II. INSTALLATION

### 2-3. Bench Use.

Verify that the instrument has been connected for the input voltage on which it is to be used. Units are normally wired for operation on 115 V, 50 - 60 Hz, 1 Ø. If operation on 230 V is required, a reconnection of the power transformer is necessary. Remove the two jumpers on the power supply transformer terminals at the upper lefthand corner of the printed wiring board (viewed from the bottom), and replace with a jumper between the two inner terminals.

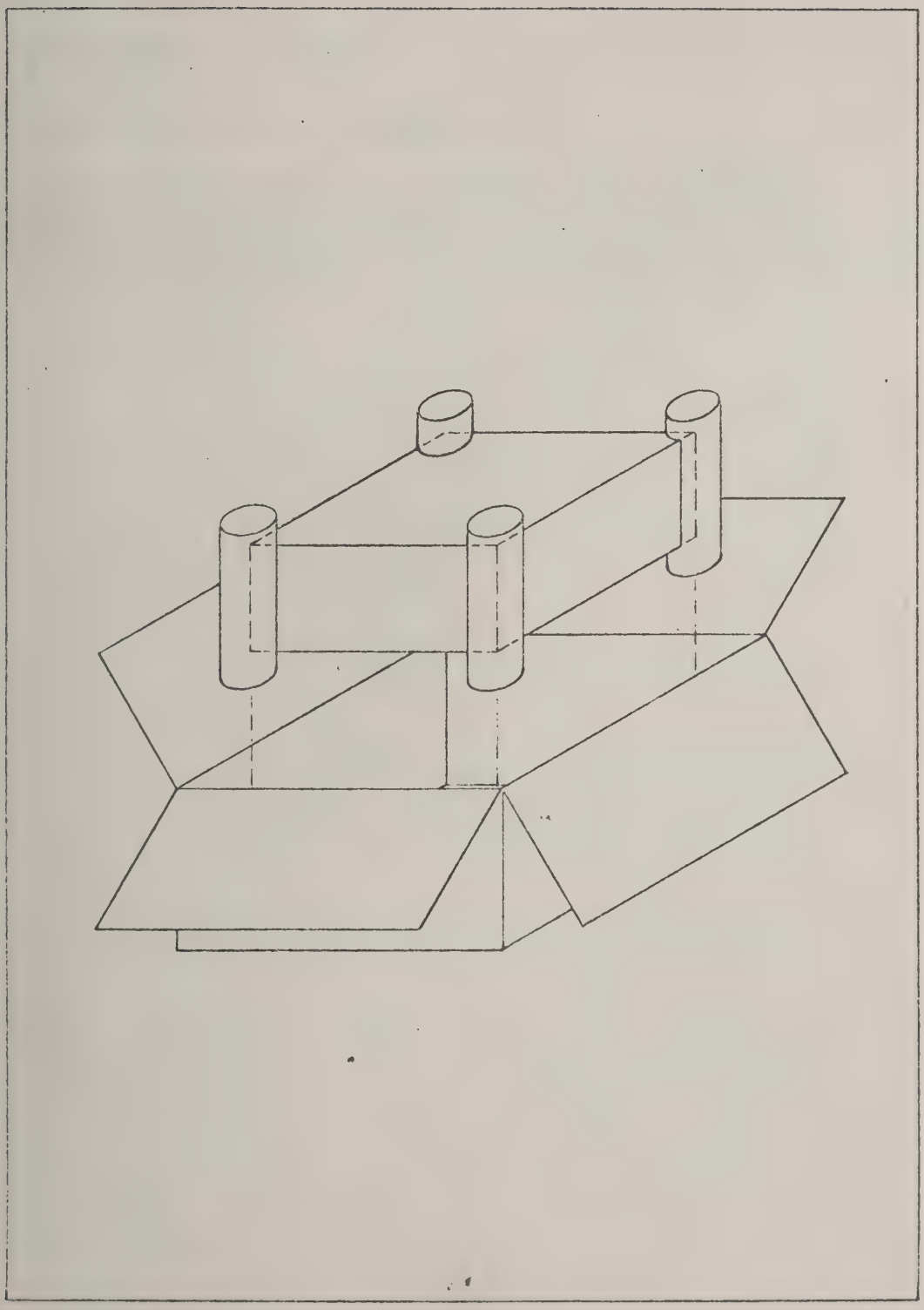


Figure 2-1. Standard Commercial Package

## 2-4. Rack Mounting.

Special adapters are required for rack mounting. If these adapters are to be used, order Option RM.

## 2-5. Functional Examination of Equipment.

A functional examination of the equipment should be made upon installation. The series of tests outlined in Chapter 4, Adjustment Procedures, is suggested. In addition to verifying the functions of the instrument, these procedures will serve as an orientation exercise in the use of the controls.

# CHAPTER 3. OPERATION

## Section I. OPERATOR'S CONTROLS

### 3-1. Operator's Controls, Indicators, and Jacks.

An illustration of the front panel controls provided in the VS series of instruments is shown in Figure 1-8. The function of each control is as follows:

1. CENTER FREQUENCY DIAL. This dial indicates the frequency of the oscillator in the CW mode, and the center frequency in the sweep mode. In the single band instruments one set of graduations is provided, and the engraved figures are filled with white enamel. In the dual band instruments a second set of graduations is engraved immediately below the figures on the outer diameter. This second set of graduations is filled with red enamel. When operating in the HIGH band of frequencies the white graduations are used. In the LOW band the red figures indicate the frequency.

2. POWER SWITCH. This switch applies power to the instrument. A red pilot light is illuminated when the power switch is in the ON position.

3. RF LEVEL SET POTENTIOMETERS. Two potentiometers are provided to set the maximum and minimum output power levels which can be obtained by varying the RF vernier control. These potentiometers are set at the factory for proper operation with the internal leveling system. They are provided as front panel controls so that if an external monitor is employed, these levels can be reset.

4. EXTERNAL MARKER SIZE CONTROL. This control permits adjustment of the external marker input signal to a level within the control capability of the birdie marker amplifier.

5. FIXED MARKER SIZE AND SHAPER. This is dual coaxial control. The inner diameter knob varies the size, or amplitude, of the birdie marker. The outer diameter knob varies the bandpass of the birdie marker amplifier, which controls the width of the birdie marker.

6. BAND SELECTOR SWITCH. In the dual band instruments, this switch selects either the HIGH or LOW band of frequencies.

7. RF VERNIER AND ALC SWITCH. This is dual coaxial control. The outer diameter knob selects either the internal or external monitor signal as the level control feedback. If no external monitor is used, this switch may be used to open the internal level control loop. The inner diameter knob provides a continuously variable adjustment of RF output over a 10 DB range.

8. ATTENUATION. This control provides from zero to 70 DB of attenuation of RF output in 10 DB steps. A second attenuator is available as an option which provides an additional 10 DB of attenuation in 1 DB steps.

9. SWEEP WIDTH CONTROL. This is a dual coaxial control. The outer diameter knob selects either the WIDE or NARROW sweep width, or provides the CW mode of oscillator operation. The inner diameter knob varies the sweep width within the range selected by the outer diameter knob.

10. SWEEP RATE CONTROL. This is a dual coaxial control. The outer diameter knob selects the mode of sweep rate operation. In LINE position, the sweep rate is locked to the power line frequency. In the VARIABLE position, two ranges of automatic sweep are available, 5 to 60 Hz and 0.05 to 5 Hz. In the MANUAL position the frequency of the oscillator may be controlled at any point within the sweep interval established by the setting of the frequency dial and the sweep width controls by adjustment of the inner knob of this control. In the EXTERNAL position the sweep may be driven by an external signal. In both the MANUAL and EXTERNAL positions blanking of retrace is disabled. The inner diameter control also varies the sweep rate within the ranges selected by the outer diameter knob in the VARIABLE positions.

11. MARKER SWITCHES. These switches are used to select the internal marker generators, either singly or in combination.

12. RF OUTPUT JACK. The RF output of the sweep generator is available at this connector.

13. EXTERNAL MARKER JACK. This connector allows an external signal source to be applied to the birdie marker system for superimposing on the detected video output.

14. VIDEO INPUT JACK. The detected RF signal from the device under test is inserted at this connector for the purpose of superimposing the birdie marker signal.

15. SCOPE VERTICAL JACK. The detected RF signal with markers superimposed is available at this connector. This signal is used as the vertical input to the external display device.

16. SCOPE HORIZONTAL. The horizontal deflection signal for the external display device is available at this connector.

3-2. Rear Panel Devices.

The following devices are located on the rear panel, as shown in Figure 3-2.

17. LINE. This is the power cord entrance to the chassis.

18. F-1. This is the receptacle for the input fuse (1 AMP).

19. EXTERNAL DRIVE JACK. The external signal for the sweep drive when in EXTERNAL sweep rate mode is inserted at this connector.

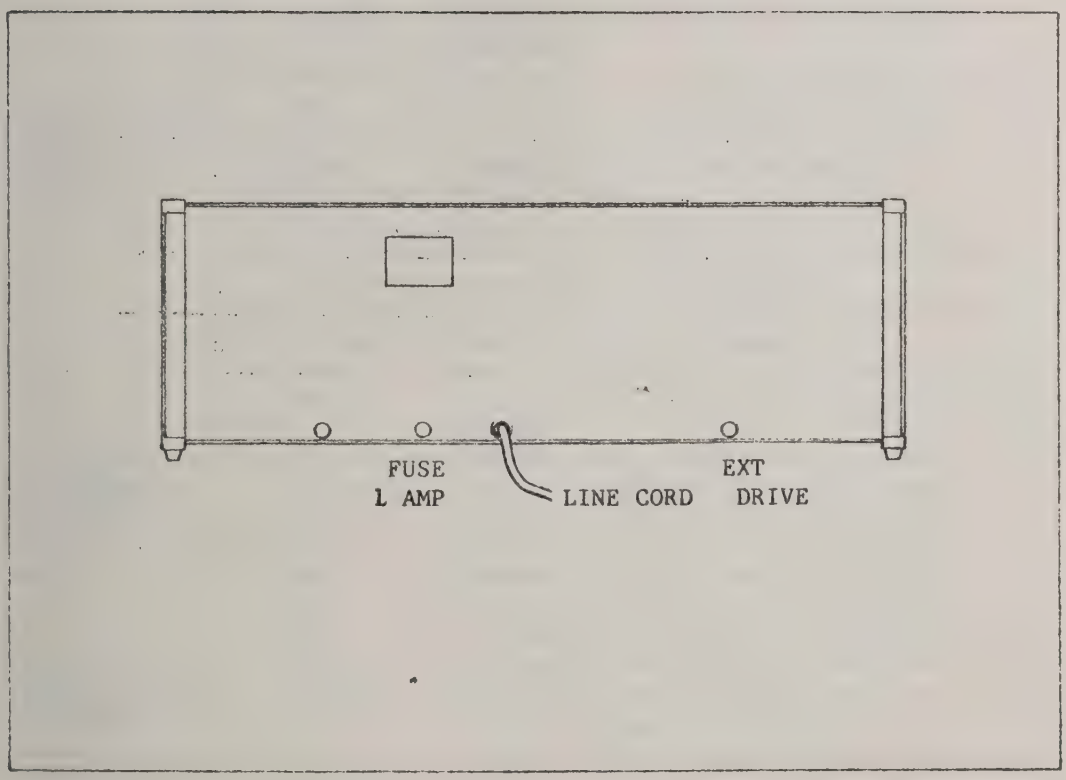



Figure 3-2. Rear Panel Devices

| FRONT PANEL CONTROLS | | |
|---|---|---|
| CONTROL | SETTING | FUNCTION |
| ALC | External | External level control |
| | Internal | Internal level control |
| RF VERNIER | Variable | Vernier control of RF level over a 10 DB range. |
| SWEEP WIDTH | Wide | Controls sweep width up to 40% of center frequency at 1000 MHz. |
| | Narrow | Controls sweep width from 50 KHz to 300 MHz. |
| | CW | Provides a fixed frequency signal. |
| SWEEP RATE | Line | Sweep rate at line frequency |
| | 5-60 Hz | Sweep rate 5-60 Hz |
| | 0.05-5 Hz | Sweep rate 0.05 to 5 Hz |
| | Manual | Manual control of sweep |
| | Ext | Sweep rate controlled by an external signal. |
| SWEEP RATE VERNIER | Variable | Varies sweep rate in variable and manual positions. |
| BAND | Low | Frequency range 1 MHz to 300 MHz |
| | High | Frequency range 300 MHz - 1000 MHz |
| MARKER SIZE EXTERNAL | Variable | Adjusts external marker level to control range of amplifier. |

| | | |
|---|---|---|
| MARKER SIZE FIXED | Variable | Controls amplitude of marker. |
| MARKER SHAPE | Variable | Controls shape of markers. |
| ATTENUATION | 0 to 70 | Provides 0 to 70 DB of attenuation. |
| MARKERS | Any | Selects designated marker. |
| CENTER FREQ | Any | Selects designated frequency. |
| RF LEVEL SET MAX | Variable | Sets upper RF output limit. |
| RF LEVEL SET MIN | Variable | Sets lower RF output limit. |

CONNECTORS

| DESIGNATION | APPLICATION |
|---|---|
| RF OUT | RF output available at this connector. |
| ALC | External level control signal input. |
| EXT MARKER | External marker generator input. |
| VIDEO IN | Input for detected RF output from device. |
| SCOPE VERT | Output to vertical channel of display. |
| SCOPE HORIZ | Output to horizontal channel of display. |

REAR PANEL DEVICES

| DESIGNATION | APPLICATION |
|---|---|
| F-1 | Fuse receptacle. |
| EXT DRIVE | Input for external sweep control signal. |
| LINE | Power cord entrance to chassis. |

Figure 3-3. Operator's Controls

## Section II. OPERATION UNDER USUAL CONDITIONS

### 3-3. Preliminary Starting Procedure.

a. Test Concept. The VS-00-0 is a test instrument, and its use requires an analysis of the test objective to be accomplished. Appendix IV shows a number of typical applications, together with the additional equipment required. These applications are shown to demonstrate the use of the instrument in conjunction with other devices in the development of a plan or test concept.

b. Assembly and Interconnection of Equipment. Assemble the equipment required, including the device to be tested. Interconnect the equipment in accordance with the test plan. Use coaxial cable of 50 ohms characteristic impedance. The VS-00-0 connectors accept a male BNC connector (plug).

### 3-4. Operator's Initial Adjustments.

a. Initial Control Adjustments. Determine the mode of operation pertinent to the test to be accomplished, and set the controls of the VS-00-0 as follows:

(1) Band switch. Set this control to the low band (1 MHz to 300 MHz), or to the high band (300 MHz to 1000 MHz), according to the frequency range required. (VS-80 only)

(2) Center frequency dial. Set this dial to the frequency required. If the sweep mode of operation is to be used, set this dial to the center of the sweep of frequency required.

(3) Sweep rate. Determine the sweep rate best suited to display the results of the test. Set the sweep rate switch accordingly.

(4) ALC control. Set the ALC control to the internal monitor, unless it has been determined that an external level control is required. In the latter case, set the ALC switch to external.

(5) Attenuation control. Set the attenuation control to maximum (70 DB).

(6) Marker switches. If frequency markers are to be used, and the markers have been provided, determine the frequency marker interval (in Hz) best suited to the range of sweep frequency to be observed. Select one or more marker switch to provide a fundamental frequency equal to the interval required.

(7) Video input. If markers are to be used, the detected output of the device under test must be connected to the video input connector of the VS-00-0.

(8) Fixed marker size. Set the fixed marker size control to mid-range.

(9) Marker shape. Set the marker shape control to mid-range.

(10) External marker size. If an external marker generator is used, the input is connected to the EXT MARKER connector. Set the fixed marker size control fully CW. Adjust the external marker size control to produce the maximum marker amplitude required.

b. Initial Adjustment of Associated Equipment. Make the necessary adjustments to associated equipment.

c. Power Cord. Insert the power cord of the VS-00-0 into a receptacle supplying 115 volts, 60 Hz, single phase.

3-5. Operating Procedure.

a. Check Interconnections. Check interconnections between the VS-00-0 and associated equipment.

b. Check Initial Adjustments. Check the initial adjustments of the VS-00-0 and any associated equipment.

c. Apply Power to Associated Equipment. Apply power to associated equipment, such as the display device, external oscillators, RF power instrumentation, etc.

d. Readjustment of Associated Equipment. Readjust the associated equipment to quiescent conditions (absence of inputs from the VS-00-0).

e. Apply Power to the VS-00-0. Place the power switch of the VS-00-0 in the ON position. The VS-00-0 employs solid state active devices, and outputs develop immediately when energized. Maximum stability will be realized after a warm-up time of 20 minutes.

f. Out of Limit Operation. Upon applying power to the VS-00-0 a signal will be delivered to the device under test and associated instrumentation. Immediately scan all associated equipment for evidence of out-of-limit operation which could result in damage to instrumentation.

g. Increase RF Output. Increase RF output of the VS-00-0 by decreasing attenuation, until an adequate display is presented on the external device.

h. Readjust Associated Equipment. Readjust associated equipment as necessary to adequately indicate or display the process under observation.

i. Readjust the VS-00-0 Controls. Readjust the VS-00-0 controls as necessary for optimum presentation on the display device.

j. Proceed with Test. Proceed with the test schedule, making the necessary changes in input to complete the exercise.

k. Stopping Procedure-Stand-By Operation. The VS-00-0 is designed for continuous operation within its ratings. No particular procedure is required for stand-by operation.

l. Stopping Procedure-Shut Down. Operation of the VS-00-0 may be discontinued simply by placing the power switch in the OFF position.

## Section III. OPERATION UNDER UNUSUAL CONDITIONS

3-6. Extreme Moist Heat.

No particular procedure is required to operate under conditions of extreme moist heat up to 50°C and 90% humidity.

3-7. Extreme Dry Heat.

No particular procedure is required to operate under conditions of extreme dry heat up to 50°C.

3-8. Extreme Cold.

No particular procedure is required to operate in temperatures down to minus 18°C. A warm-up time of 20 minutes should be allowed for maximum stability.

3-9. Salt Air and Sea Spray.

Operation in an environment of salt air and sea spray requires that the instrument be protected completely from infiltration of these elements.

3-10. Sand and Dust Storms.

Operation in an environment of sand and dust requires that the instrument be protected from infiltration of these elements.

## Section IV. OPERATION UNDER EMERGENCY CONDITIONS

### 3-11. Operation under Reduced Power.

At any time the input power to the VS-00-0 falls below 105 volts, a variable auto-transformer (Variac or Powerstat) should be used to provide a nominal input voltage of 115 V AC.

### 3-12. Partial Power Failure.

a. In the event of a partial power failure resulting in loss of voltage only, follow procedure under paragraph 3-11.

b. In the event that minimum voltage of 105 V AC cannot be obtained, an auxillary power unit producing 105-125 V AC, 50 to 70 Hz may be employed as a power source. A minimum power output of 20 watts should be provided.

### 3-13. Failure of Part of the Equipment.

The VS-00-0 is an integrated equipment, and it will not function with a partial system failure.

# CHAPTER 4.

# ADJUSTMENT OF INSTRUMENT

## Section I. GENERAL REQUIREMENTS

### 4-1. Scope.

This chapter covers an examination of the instrument, and adjustment of the oscillator system, sweep rate, sweep width, and the power supplies.

### 4-2. Tools and Equipment Required.

#### 4-2.1 Tools Required.

Screwdriver

Allen wrenches, #4, #6

Oscillator adjustment tool J.F.D. #5284 (cut in two)

Potentiometer adjustment tool, General Cement #9087

#### 4-2.2 Equipment Required.

Oscilloscope, Tektronix Type 504 or equal

RF Detector, Texscan CD-51, or equal.

Harmonic marker, 50 MHz, Texscan HM-50 plug-in type, or equal.

Interconnecting cables, RG-223/U with UG-88C/U connectors.

Adapters (2), UG-201/U (For oscilloscope inputs)

Multimeter, Simpson Model 260 or equal.

## Section II. ADJUSTMENT PROCEDURES

### 4-3. Specification requirements.

The adjustment procedures are based on instrument performance represented in manufacturer's published data.

4-4. Power Supply, +30 V DC.

Connect the VS-00-0 to a multimeter (2%) and an oscilloscope, as shown in Figure 4-4, using test point TP-1. Adjust potentiometer R-7, shown in Figure 4-4B, to provide an indication of +30 V, ± 0.6 V. Set the oscilloscope to a vertical sensitivity of 1 mV/cm, and use A.C. coupling. Measure the A.C. component (ripple) present. The ripple shall not exceed 6 mV peak to peak.

4-5. Power Supply, -30 V DC.

Connect the multimeter and oscilloscope to TP-2, shown in Figure 4-4B. Adjust potentiometer R-14 to provide an indication of -30 V, ± 0.6 V. The A.C. component (ripple) shall not exceed 4 mV peak to peak.

4-6. Power Supply, +200 V DC.

Connect the multimeter and oscilloscope to TP-3, as shown in Figure 4-4B. Adjust potentiometer R-21 to provide an indication of +200 V, ± 4.0 V. The A.C. component shall not exceed 6 mV peak to peak.

4-7. Power Supply, +50 V DC.

Connect the multimeter and oscilloscope to TP-4, as shown in Figure 4-4B. The indicated voltage shall be from +45 to +62. The A. C. component (ripple) shall not exceed 500 mV.

4-8. Sweep Rate, Manual Mode.

In the manual mode of sweep rate operation, the sweep drive instruction is created by dividing the +30 V power supply. Potentiometer R-120 contains two sections, one section of which is a part of the above mentioned dividing network, and is varied by the sweep rate vernier control. All of the automatic sweep rates are referenced to the excursion of voltage provided by the manual sweep rate instruction. No adjustment of the range or D.C. level of this manual sweep rate instruction is incorporated in the instrument. Minor variations will exist from instrument to instrument, due to component tolerances. The calibration procedure consists of a measurement to determine that the excursion of voltage is within prescribed limits.

Connect an oscilloscope to the instrument as shown in Figure 4-8. Using a vertical sensitivity of 2 V/cm, measure the maximum and minimum deflection of the trace as the sweep rate vernier is varied from fully CCW to fully CW. The total deflection from minimum to maximum shall be at least 5 cm, equal to 10V. The D.C. level of the deflection shall not exceed ± 5 cm, equal to ± 10 V.

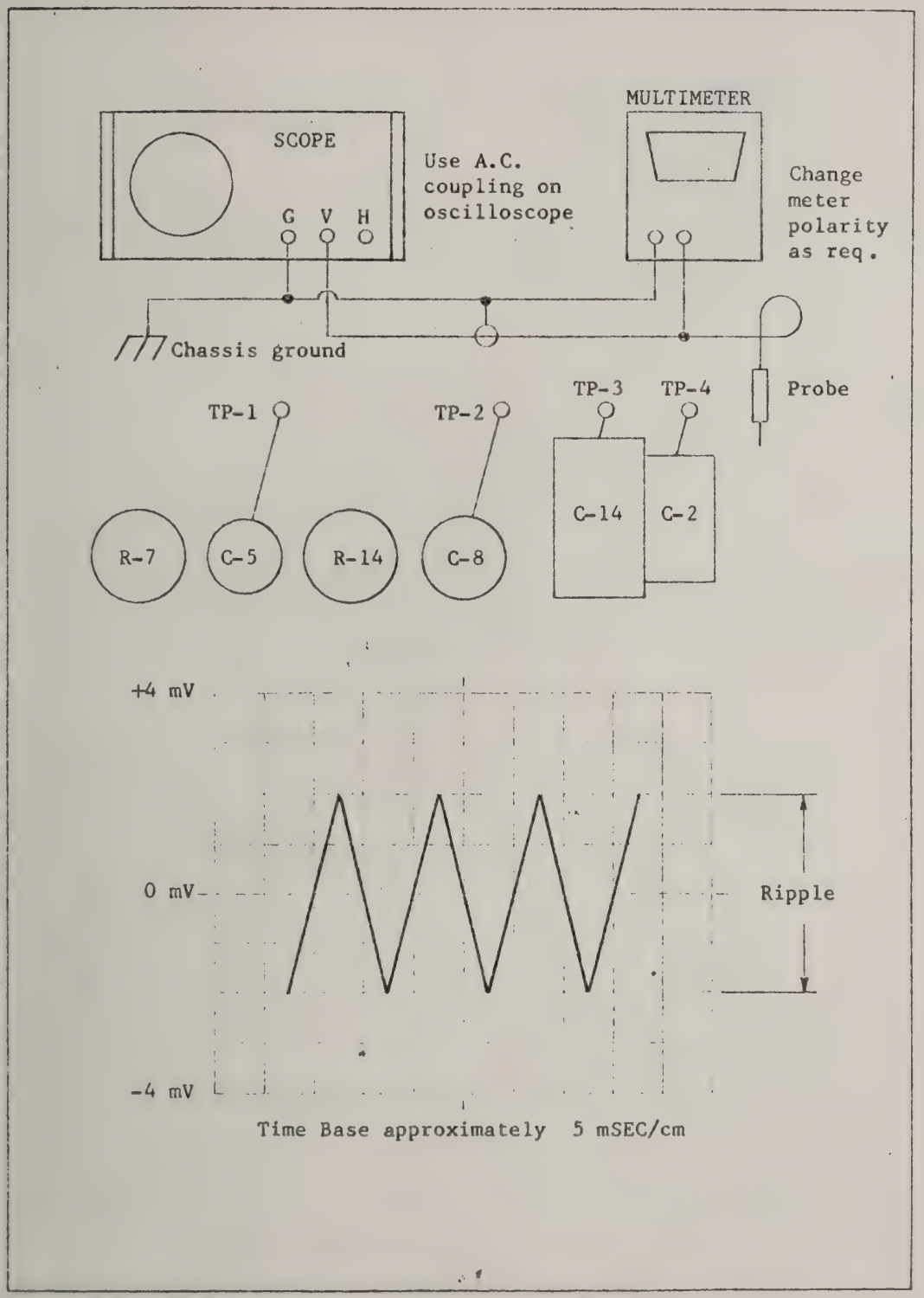



Figure 4-4. Power Supply Adjustment

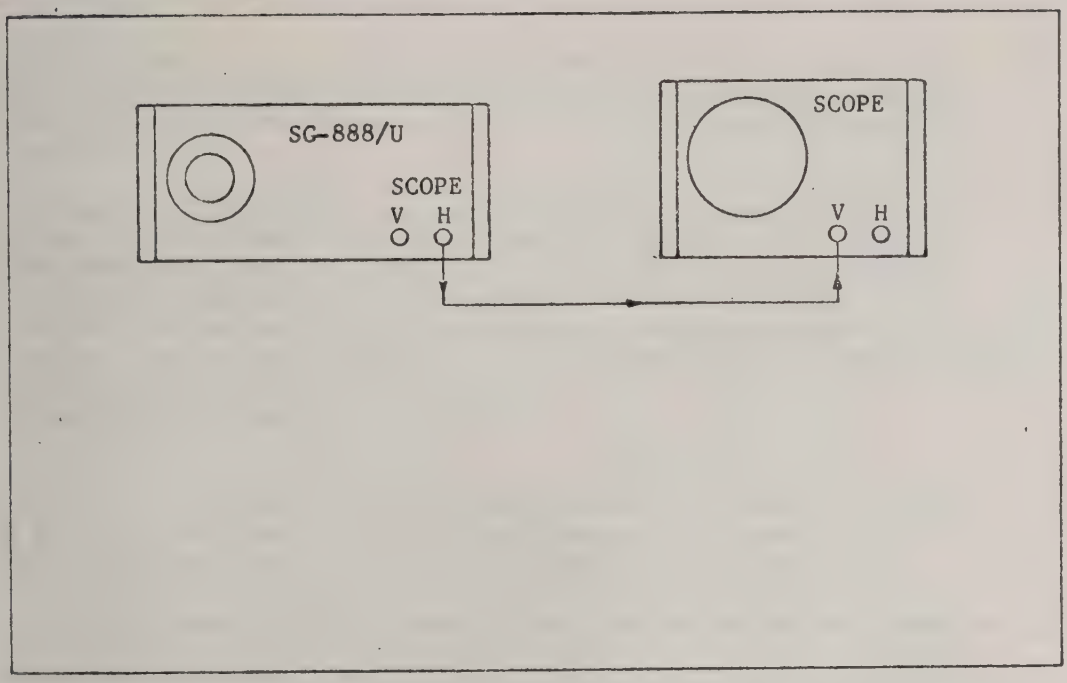



Figure 4-8.A Measurement of Horizontal Output Voltage

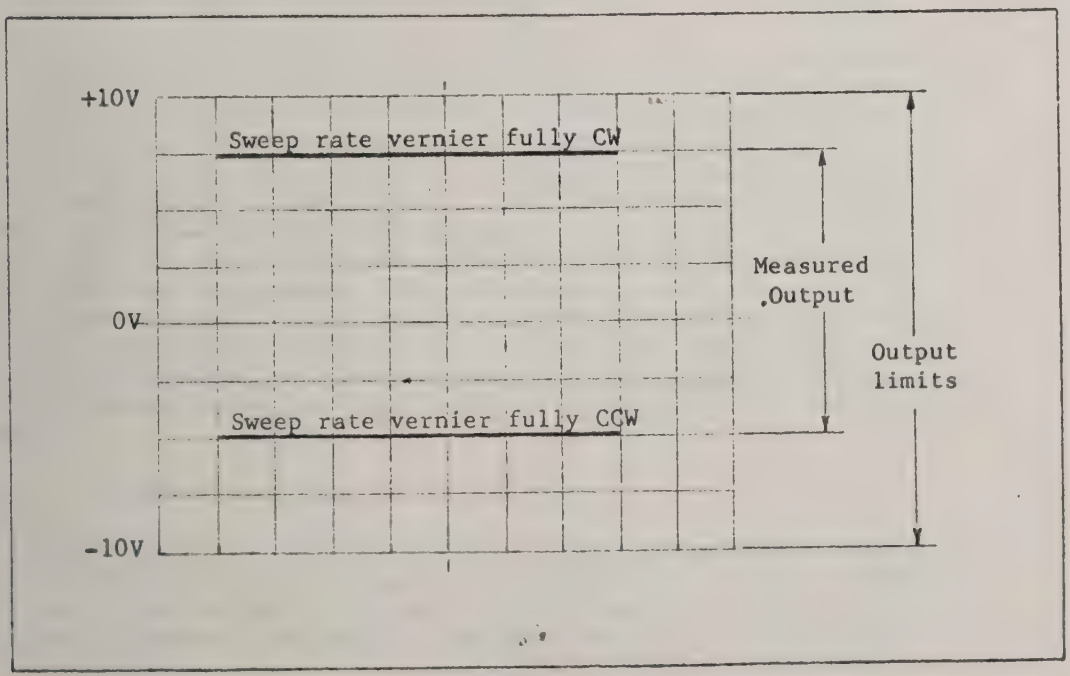



Figure 4-8.B Oscilloscope Display - Horizontal Output

4-9. Sweep Rate Trigger Points.

The trigger points of the variable sweep rate mode of operation will be adjusted to provide an excursion of voltage which coincides with the maximum and minimum points of the manual mode of sweep rate operation.

Connect the instrument to an oscilloscope as shown in Figure 4-9A. Set the vertical sensitivity to 2 V/cm, and use a time base for the horizontal axis which will present at least one complete waveform in the various sweep rates to be adjusted. Set the sweep mode selector to MANUAL, and adjust the vertical gain and centering controls to provide a deflection extending from the bottom horizontal graticule to the top graticule as the sweep rate vernier is rotated from fully CCW to fully CW, as shown on Figure 4-9B.

Without changing the setting of the vertical amplifier of the oscilloscope, set the sweep rate mode selector to VARIABLE - 5 to 60 Hz. Set the time base of the oscilloscope to present at least one complete waveform. Alternately adjust upper trigger point potentiometer R-101 and lower trigger point potentiometer R-108 to position the peaks of the triangular waveform at the extreme upper and lower graticules of the oscilloscope. These controls are to some extent interdependent. The adjustment can be expedited by considering the upper trigger point adjustment as a set point, and the lower trigger point adjustment as a span adjustment. It follows that the upper trigger point should be adjusted first.

4-10. Line Trigger Amplitude and D.C. Level.

In the LINE mode of sweep rate operation, the sweep of frequency is synchronized with the power line frequency. In the adjustment of the line mode of sweep rate operation, the line trigger amplitude control R-119 varies the span of the voltage representing the drive instruction. The line D.C. level control R-106 determines the D.C. level over which the span occurs. To calibrate the LINE sweep rate span and D.C. level, the oscilloscope is adjusted as described in paragraph 4-9, again using the voltage levels of the MANUAL mode as references for adjustment. The instrument is then placed in the LINE mode of sweep rate operation, and the line trigger amplitude potentiometer R-119 and line D.C. level potentiometer R-106 alternately adjusted to position the peaks of the triangular waveform at the extreme upper and lower horizontal graticules of the oscilloscope.

4-11. Variable Sweep Rate - 0.05 to 5 Hz.

The frequency of the various sweep rates is measured by presenting the horizontal output voltage on the vertical axis of the oscilloscope, and measuring the period of the resulting waveform, using an appropriate calibrated time base for the horizontal axis deflection.

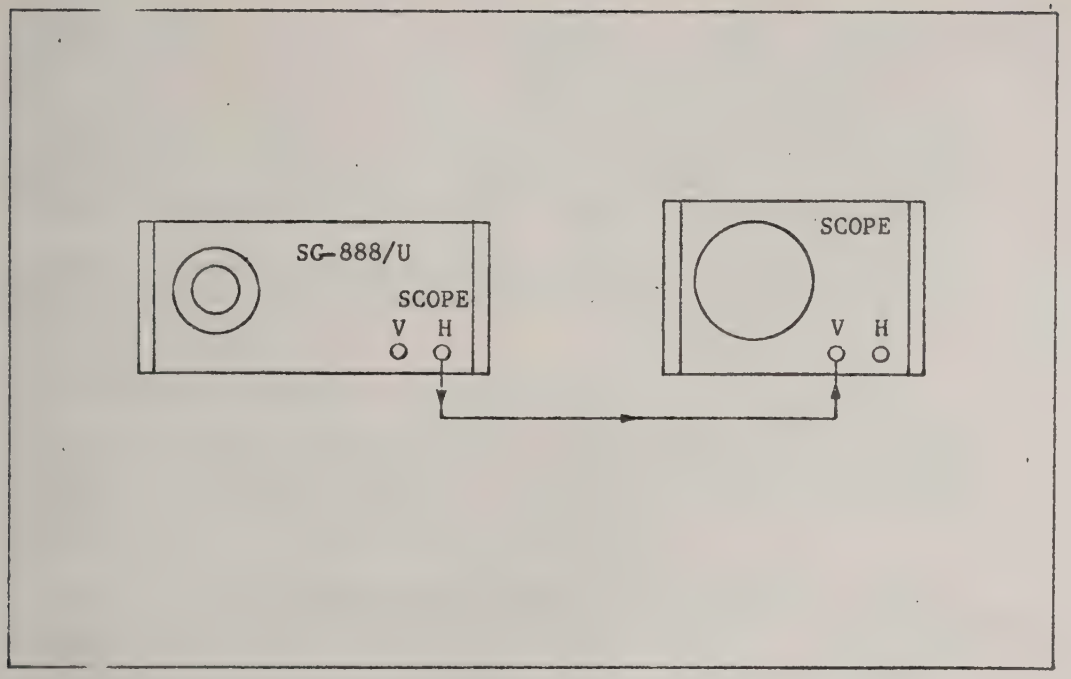



Figure 4-9.A Sweep Rate Trigger Point Adjustment

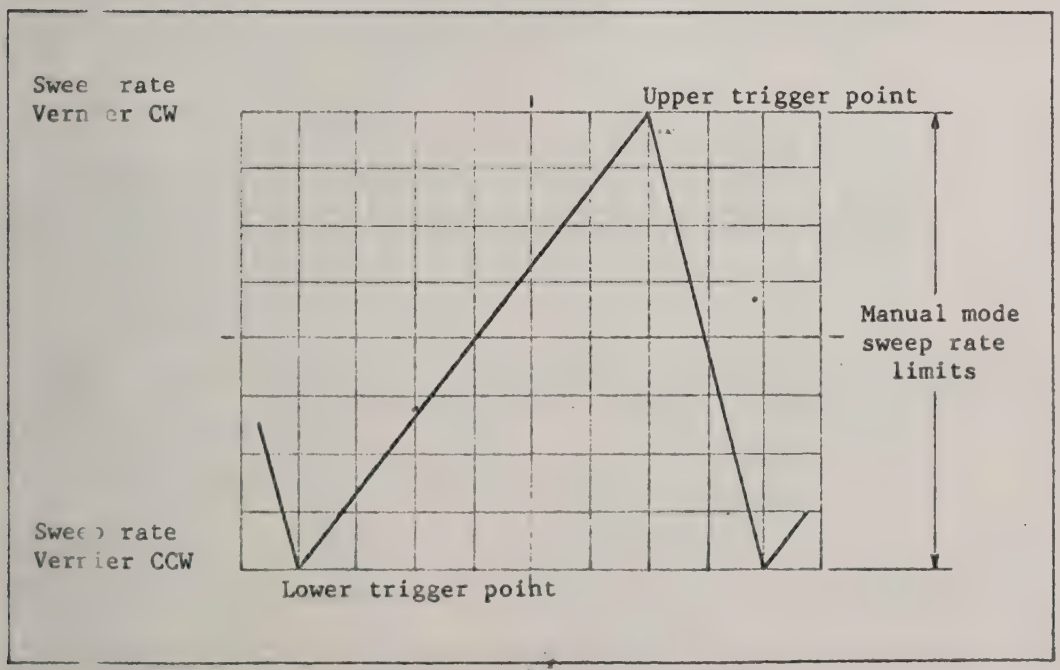



Figure 4-9.B Display of Trigger Points

Connect the instrument to an oscilloscope as shown in Figure 4-11A. Adjust the oscilloscope controls to present the display shown in Figure 4-11B. Set the sweep rate selector switch to VARIABLE - 0.05 to 5 Hz, and turn the sweep rate vernier fully CW. Set the time base of the oscilloscope to a value which will present at least one complete waveform (20 mSEC/cm). Measure the period of the waveform, as shown in Figure 4-11B. The period shall be less than 200 mSEC.

Repeat the measurement of waveform period with the sweep rate vernier fully CCW. Use a time base of 5 SEC/cm. The period shall be greater than 20 seconds.

4-12. Variable Sweep Rate - 5 to 60 Hz.

Use the same procedure described in paragraph 4-11. Set the sweep rate selector switch to VARIABLE - 5 to 60 Hz. Set the sweep rate vernier fully CW. Use a time base of 2 mSEC/cm. The period of the triangular waveform shall be less than 16.7 mSEC.

Repeat the above measurement with the sweep rate vernier fully CCW. Use a time base of 50 mSEC/cm. The period shall be greater than 200 mSEC.

4-13. LINE Mode of Sweep Rate.

Use the same procedure described in paragraph 4-11. Set the sweep rate selector to LINE. The sweep rate vernier will have no effect in this position. Measure the period of the triangular waveform, using a time base of 2 mSEC/cm. The period shall be 16.67 mSEC at 60 Hz, $\pm$ line frequency variation.

4-14. External Sweep Rate.

Blanking and rate circuits are disabled in this position. An input signal in the range of + 2 V DC to +22 V DC applied to the input connector on the rear panel (EXT) shall produce a horizontal output voltage range of at least - 5 to + 5 V DC.

4-15. Frequency Dial Accuracy.

Connect the instrument to an oscilloscope and RF detector as shown in Figure 4-15A. Adjust the oscilloscope controls to produce a pattern as shown in Figure 4-15B.

Set the controls of the instrument as follows:

| | |
|---|---|
| Band switch . . . . . HIGH | Sweep width . . . . . CW |
| Marker switch . . . 50 MHz | Marker size . . . . .MID-RANGE |
| Attenuator . . . . . 0 DB | RF vernier . . . . . CW |
| Monitor (ALC) . . . . . INT | |

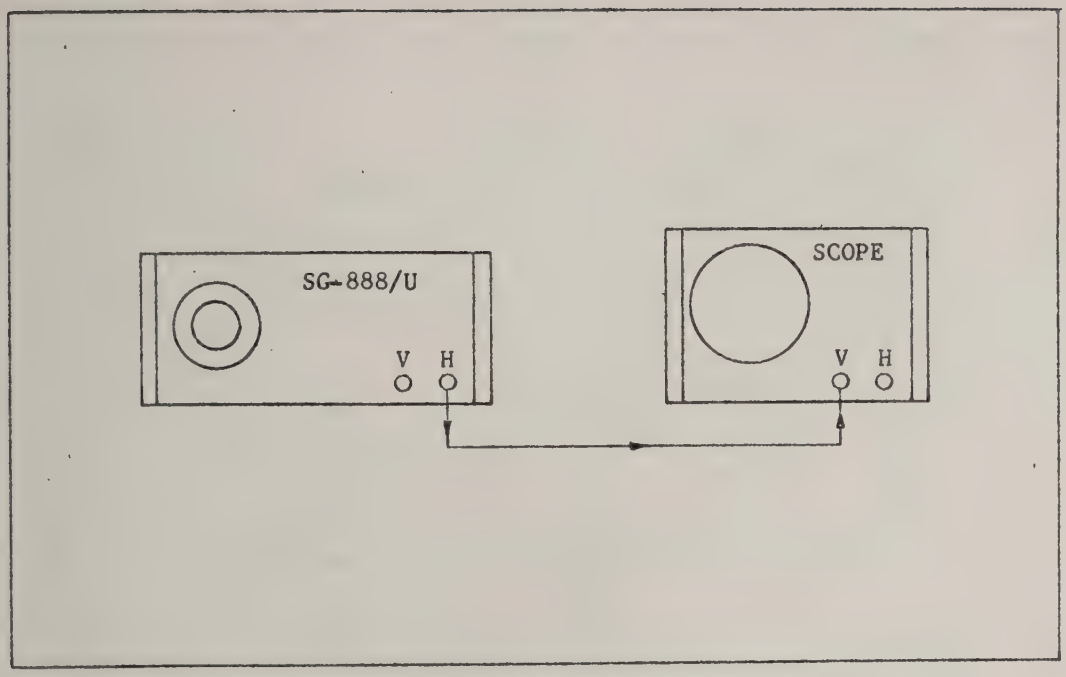



Figure 4-11.A Variable sweep rate waveform measurement

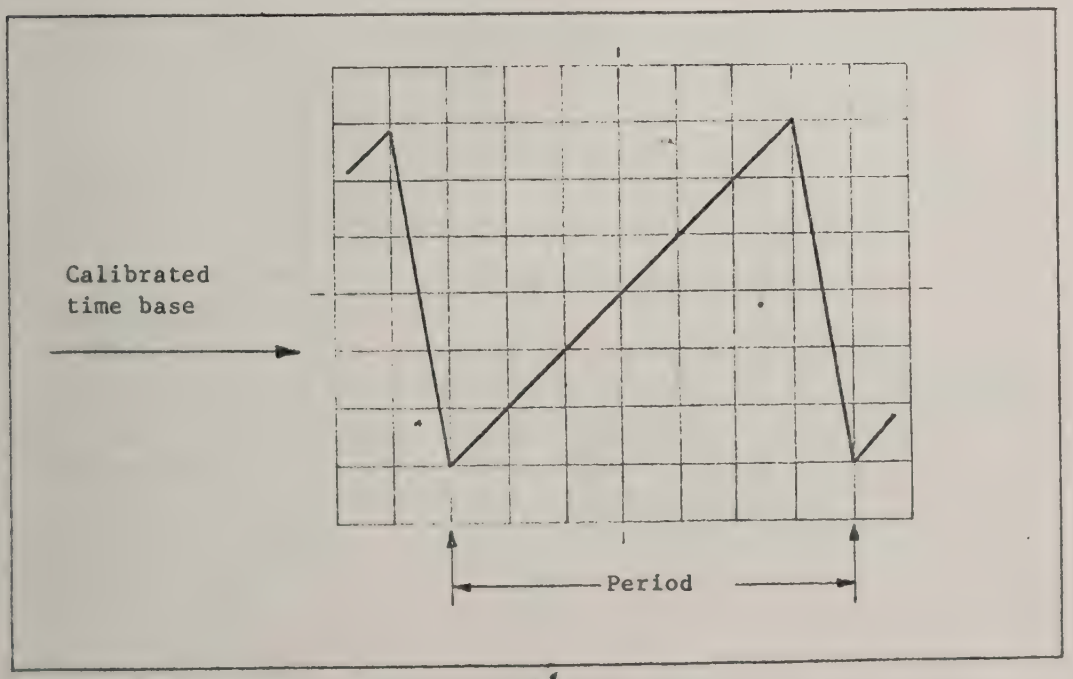



Figure 4-11.B Waveform display for measurement of period

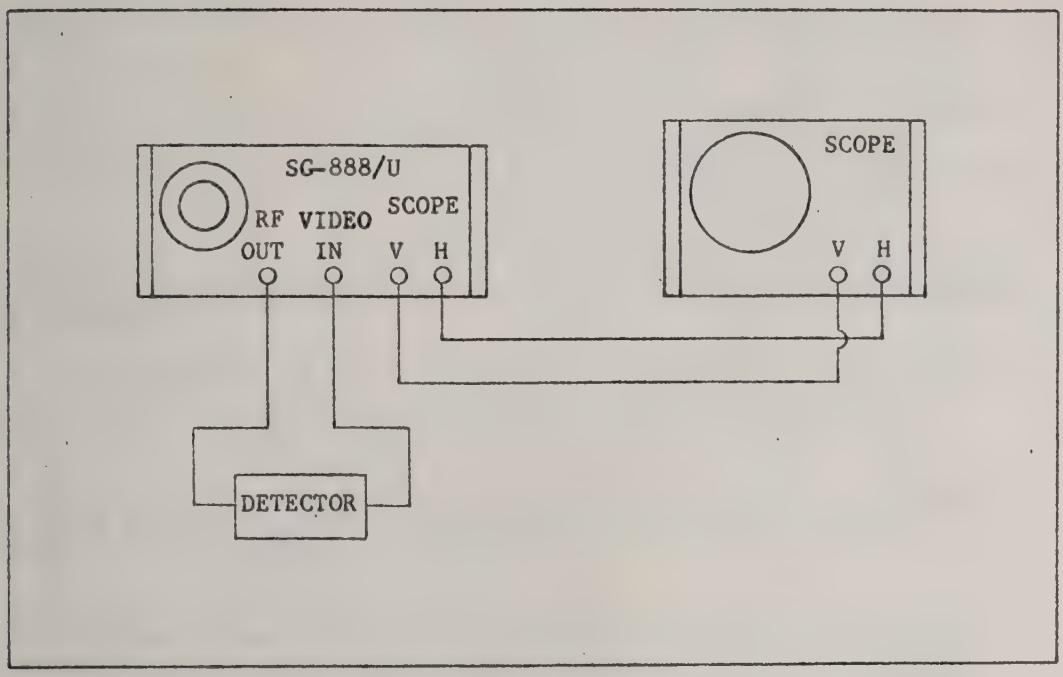



Figure 4-15.A Frequency Dial Accuracy

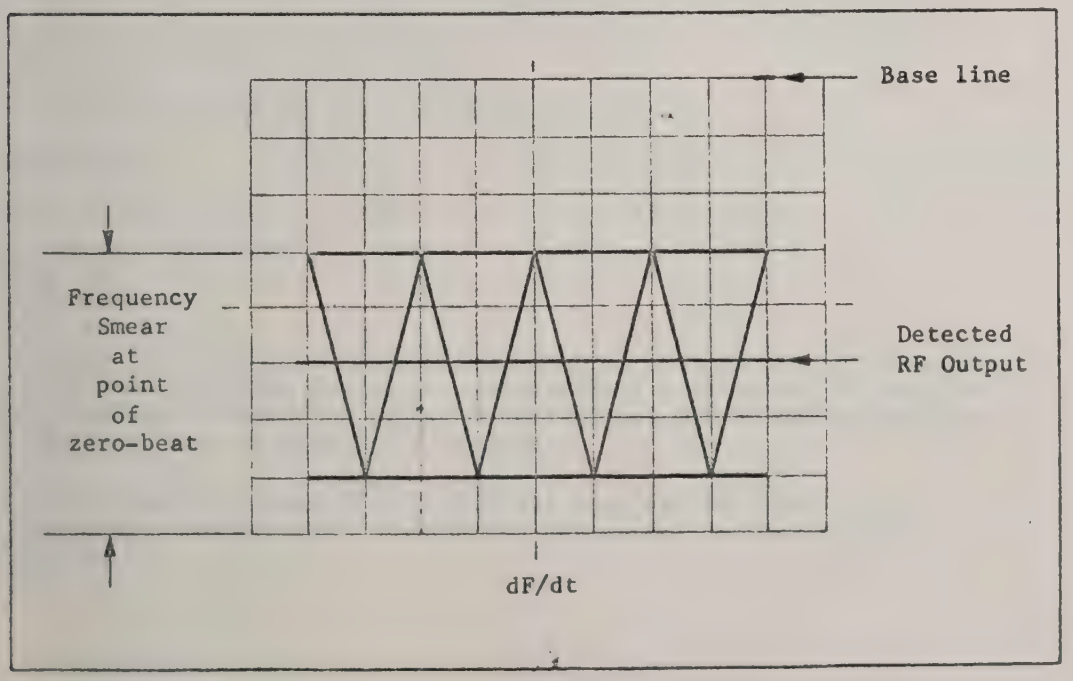



Figure 4-15.B Display at Zero-beat

Tune the frequency dial in the vicinity of 1000 MHz until the straight line oscilloscope display expands, indicating the presence of a birdie marker which is a harmonic of 50 MHz. Carefully adjust the frequency dial to display the zero-beat point. Note the position of 1000 MHz graduation on the frequency dial. The 1000 MHz graduation shall be within 1/5 of a division of the index mark. (The dial accuracy shall be within 1% of the indicated frequency of 5 MHz, whichever is the greater. The dial is graduated in 50 MHz divisions.)

Repeat the above test at each graduation between 300 and 1000 MHz, adjusting the interpolation of each division tolerance as the frequency is decreased.

After completion of the above series of tests, set the frequency dial to 1000 MHz, and fine tune until the zero beat point of the birdie marker appears on the display.

Set the band switch to LOW. Adjust the fixed frequency oscillator as shown in Figure 4-15C until the zero beat point of the birdie appears on the display.

Now tune the frequency dial to zero MHz on the red scale. Again fine tune until the straight expands, indicating the zero beat point. Note the position of the zero graduation with respect to the index. The indication shall be within 5 MHz of the zero graduation.

4-16. RF Vernier.

Connect the instrument to an oscilloscope and RF detector as shown in Figure 4-16A. Adjust the oscilloscope controls to display a pattern as shown in Figure 4-16B.

Set the controls of the instrument as follows:

| | | | |
|---|---|---|---|
| Band switch . . . . . | HIGH | Frequency dial . . . . . | 1000 MHz |
| Sweep width . . . . . | WIDE | Sweep width vernier . . . . . | CW |
| Sweep rate . . . . . | LINE | RF vernier . . . . . | CW |
| Attenuator . . . . . | 0 DB | | |

Using a high efficiency detector, such as the Texscan CD-51, the detected output trace should be approximately 6 cm below the baseline at a vertical sensitivity of 0.1 V/cm. Adjust the RF MAX potentiometer to present this deflection, if necessary.

Rotate the RF vernier fully CCW, and note the position of the detected RF output trace. Return the RF vernier to the fully CW position.

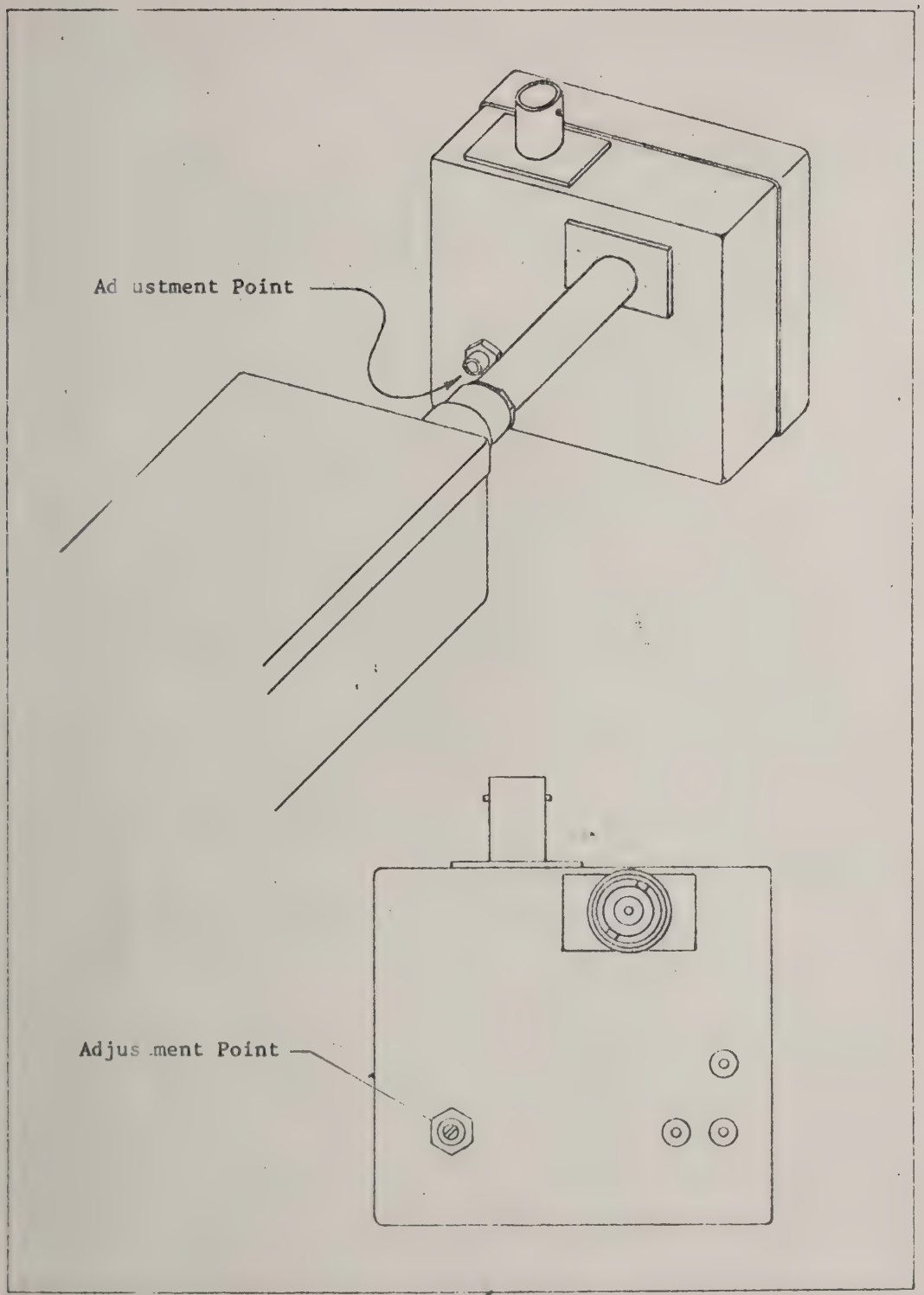



Figure 4-15.C CW Oscillator Frequency Adjustment

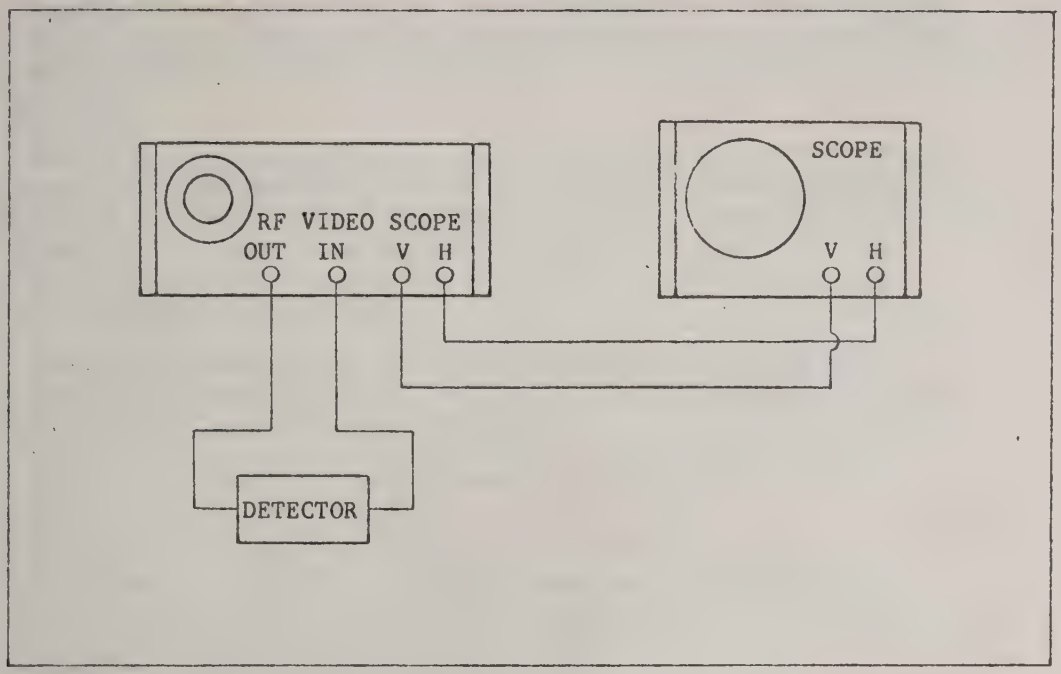



Figure 4-16.A Test Set-up for Evaluation of RF Control

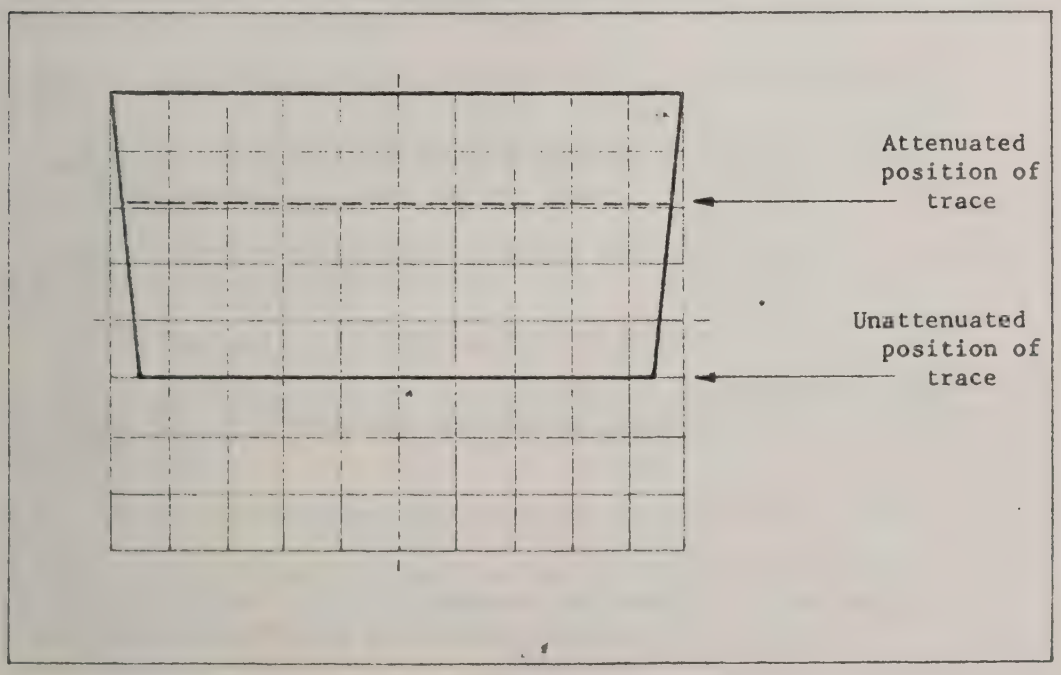



Figure 4-16.B Test pattern for RF Control

Set the attenuator at 10 DB. Note the position of the detected RF output trace. The position of the attenuated output trace shall coincide with the position of the trace when the RF vernier was fully CCW.

Note: The MAX and MIN RF output levels were set at the factory using a RF power meter. Using a high efficiency detector, these levels should range from a minimum of 0.19 V to a maximum of 0.6V as the vernier is rotated throughout its range.

4-17. Flatness of RF Output.

Connect the instrument to an oscilloscope and an RF detector as shown in Figure 4-17A. Adjust the oscilloscope controls to present a display as shown in Figure 4-17B.

Set the controls of the instrument as follows:

| | | | |
|---|---|---|---|
| Band switch . . . . . | HIGH | Frequency dial . . . . . | 1000 MHz |
| Sweep width . . . . . | WIDE | Sweep width vernier . . . . | CW |
| Sweep rate . . . . . | LINE | Attenuator . . . . . | 0 DB |
| RF vernier . . . . . | CW | | |

Note the position of the detected output trace.

Insert a standard 1 DB attenuator between the RF output connector and the detector. Note the position of the attenuated trace. Remove the attenuator, and reconnect the detector to the RF output.

The two positions of the trace represent a 1 DB difference in RF output.

Rotate the frequency dial between 300 and 1000 MHz, noting the maximum and minimum positions of the trace.

Using linear interpolation, determine that the detected RF output does not vary more than $\pm$ 0.5 DB.

Set the band switch to LOW, and the sweep width to CW.

Rotate the frequency dial between zero and 300 MHz (red scale), and again determine that the detected RF output does not vary more than $\pm$ 0.25 DB.

4-18. Harmonic Distortion, Spurious Content, and Residual FM.

The quality of the RF signal can best be determined using a spectrum analyzer. Follow procedures recommended in the instruction manual applicable to the particular equipment to be used.

Harmonic distortion and spurious outputs shall be at least 25 DB down from the fundamental. The residual FM shall be better than 5 KHz at 300 MHz, and better than 20 KHz at 1000 MHz (HIGH band).

4-19. Sweep Width.

The adjustment and calibration of sweep width is concerned with the alignment and spread adjustment of the sweep drive circuit. The primary input to the sweep drive circuit is derived from the rate circuit, and it is important that the latter circuit be adjusted before calibration of the sweep drive circuit is undertaken.

The objective to be accomplished in the adjustment of sweep width is to provide the required sweep of frequency in the various ranges of sweep width, and at the same time maintain the center of the frequency sweep in alignment with the indication of the frequency dial.

It will be helpful to keep in mind when adjusting sweep width that the actual position of the frequency sweep in the spectrum is controlled by two factors, namely, the setting of the frequency dial and the drive supplied to the frequency modulating diode of the variable frequency oscillator. When a position has been established for the center frequency dial, this position should be maintained while adjusting the location of the center of the frequency sweep throughout the range of the sweep width vernier. The setting of the frequency dial should be established at some minimal value of sweep width, since the resolution in positioning the dial is much greater under this condition.

Five internal adjustments have been provided to permit maximum flexibility in establishing the characteristics of the sweep drive. These controls are interacting, which requires that adjustments be made incrementally, followed by readjustment as error is eliminated.

4-19.1 Adjustment of wide sweep width - HIGH band.

Connect the instrument to an oscilloscope and an RF-detector as shown in Figure 4-19A. Adjust the oscilloscope controls to display a pattern as shown in Figure 4-19B.

Set the controls of the instrument as follows:

| | | | |
|---|---|---|---|
| Band switch | HIGH | Frequency dial | 1000 MHz |
| Sweep width | WIDE | Sweep width vernier | CW |
| Attenuator | 0 DB | RF vernier | CW |
| Marker switch | 50 MHz | Marker controls | MID-RANGE |
| Sweep rate | LINE | | |

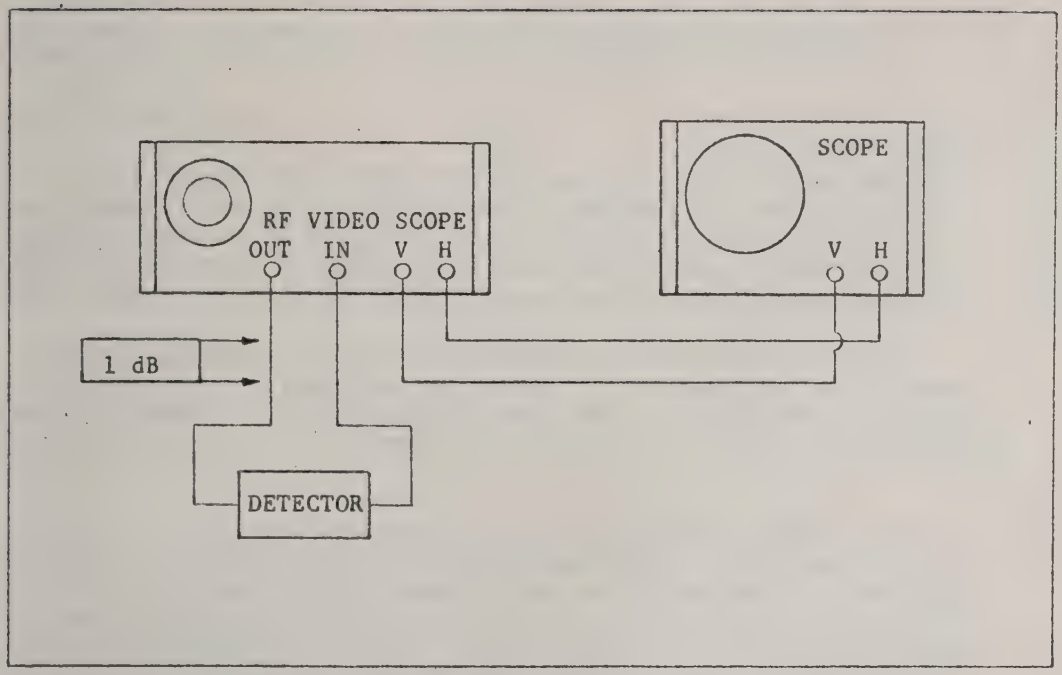



Figure 4-17.A Test set-up for Flatness Measurement

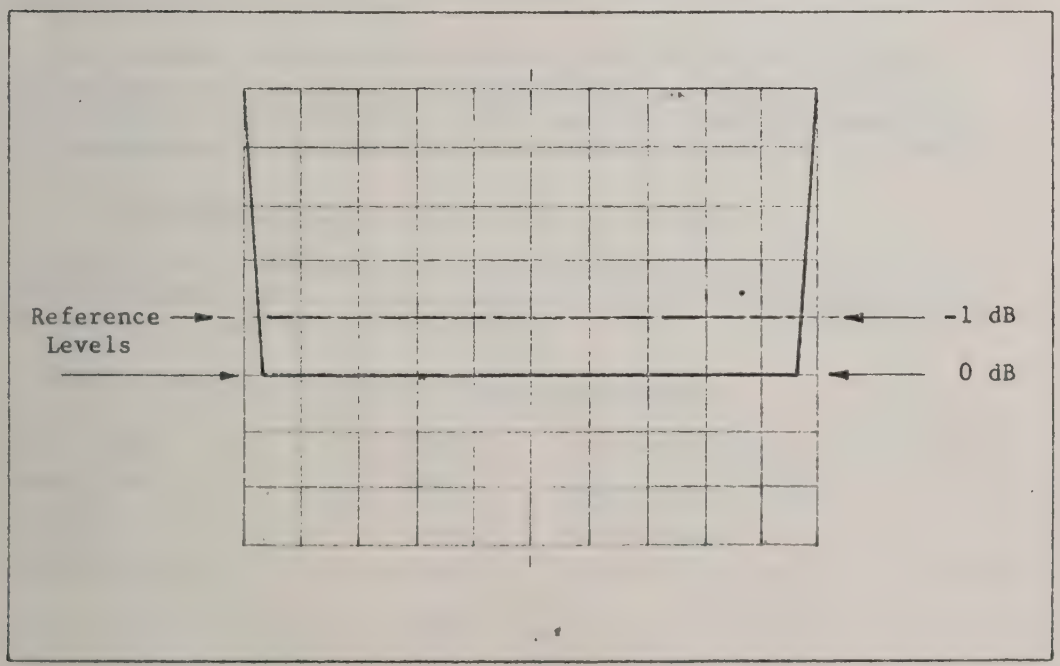



Figure 4-17.B Oscilloscope Display for Flatness

Harmonic distortion and spurious outputs shall be at least 25 DB down from the fundamental. The residual FM shall be better than 5 KHz at 300 MHz, and better than 20 KHz at 1000 MHz (HIGH band).

4-19. Sweep Width.

The adjustment and calibration of sweep width is concerned with the alignment and spread adjustment of the sweep drive circuit. The primary input to the sweep drive circuit is derived from the rate circuit, and it is important that the latter circuit be adjusted before calibration of the sweep drive circuit is undertaken.

The objective to be accomplished in the adjustment of sweep width is to provide the required sweep of frequency in the various ranges of sweep width, and at the same time maintain the center of the frequency sweep in alignment with the indication of the frequency dial.

It will be helpful to keep in mind when adjusting sweep width that the actual position of the frequency sweep in the spectrum is controlled by two factors, namely, the setting of the frequency dial and the drive supplied to the frequency modulating diode of the variable frequency oscillator. When a position has been established for the center frequency dial, this position should be maintained while adjusting the location of the center of the frequency sweep throughout the range of the sweep width vernier. The setting of the frequency dial should be established at some minimal value of sweep width, since the resolution in positioning the dial is much greater under this condition.

Five internal adjustments have been provided to permit maximum flexibility in establishing the characteristics of the sweep drive. These controls are interacting, which requires that adjustments be made incrementally, followed by readjustment as error is eliminated.

4-19.1 Adjustment of wide sweep width - HIGH band.

Connect the instrument to an oscilloscope and an RF detector as shown in Figure 4-19A. Adjust the oscilloscope controls to display a pattern as shown in Figure 4-19B.

Set the controls of the instrument as follows:

| | | | |
|---|---|---|---|
| Band switch . . . . . | HIGH | Frequency dial . . . . | 1000 MHz |
| Sweep width . . . . . | WIDE | Sweep width vernier . . . . | CW |
| Attenuator . . . . . | 0 DB | RF vernier . . . . . | CW |
| Marker switch . . . . . | 50 MHz | Marker controls . . | MID-RANGE |
| Sweep rate . . . . . | LINE | | |

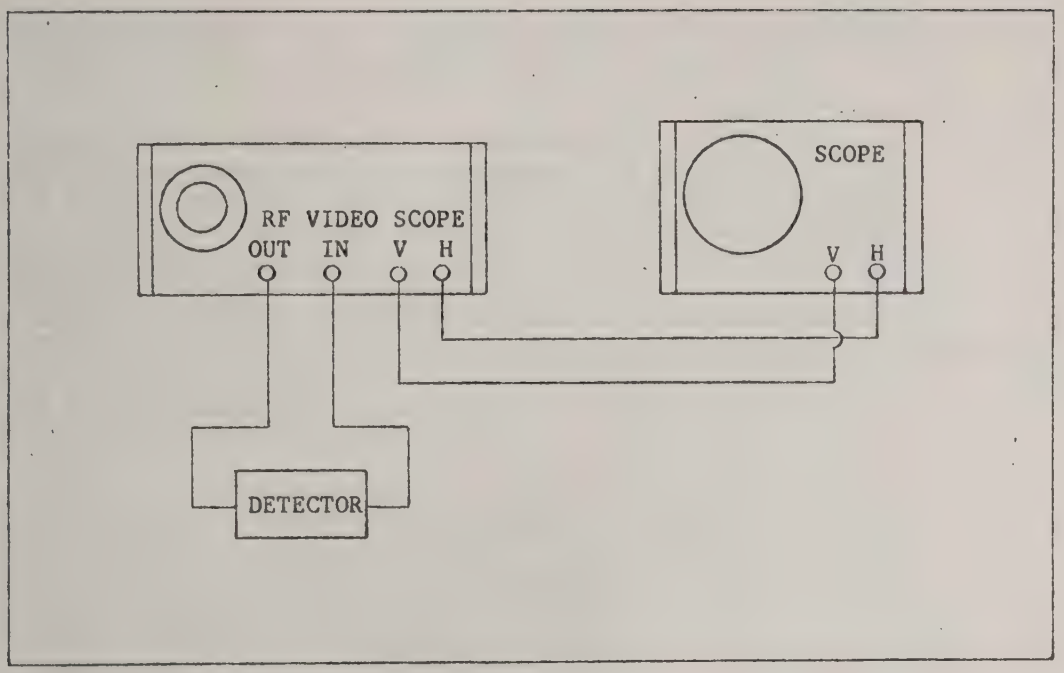



Figure 4-19.A Test set-up to adjust Sweep Width

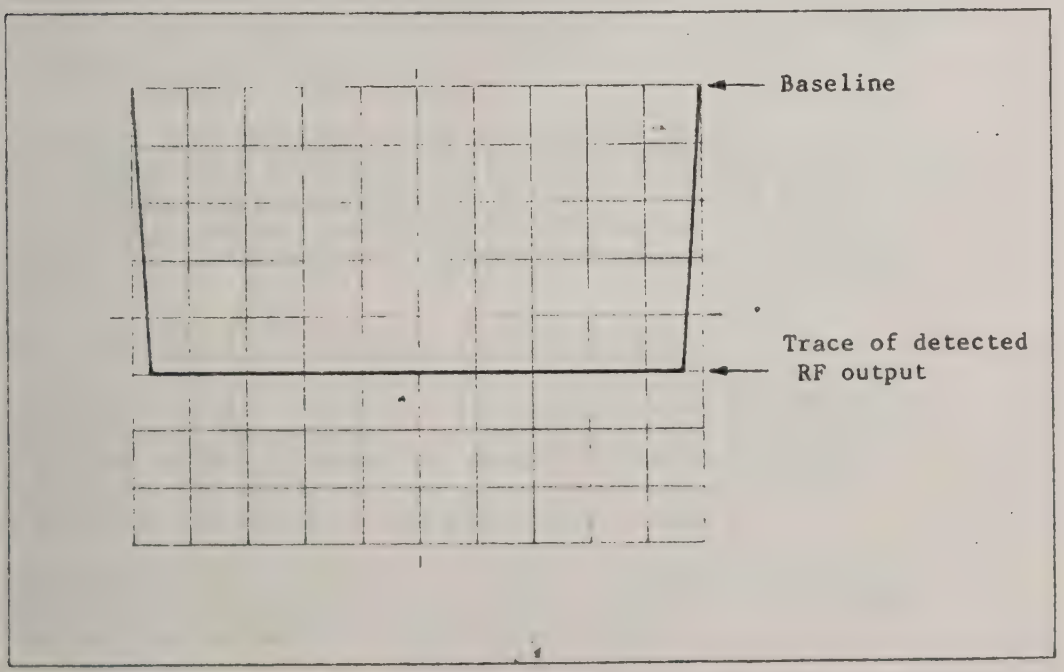



Figure 4-19.B Display for adjustment of Sweep Width

Alternately adjust wide sweep width limit (WSWL) potentiometer R-159 and wide sweep center frequency (WSCF) potentiometer R-161 to produce a sweep width of 400 MHz, as shown in Figure 4-19C.

Identify the 1000 MHz marker. This may be accomplished in a number of ways using additional equipment. However, due to the range of the instrument, which has been limited by a mechanical stop on the tuning line, the 1000 MHz marker will be the highest frequency marker which can be presented on the oscilloscope display at WIDE sweep width with the sweep width vernier fully CCW. If the 1000 MHz marker is identified in this way, the sweep width may be advanced, and the shift in position of the 1000 MHz marker followed. Needless to say, a higher confidence level can be established by using an external marker signal of known frequency, or a Texscan single frequency (SM) plug-in marker.

With the 1000 MHz marker in the center of the oscilloscope trace, reduce the sweep, at the same time adjusting medium sweep width center frequency potentiometer (MSCF) R-132 to keep the marker in the center of the screen. When the sweep width vernier reaches a position representing approximately one-third of full CW rotation, and with the marker in the center of the oscilloscope trace, return the sweep width vernier to the fully CW position. Note the position of the 1000 MHz marker under these conditions.

Now rotate the sweep width vernier to the one-third position, and adjust MSCF potentiometer R-132 to place the marker in the same position which it occupied when the vernier was fully CW. It should now be possible to rotate the sweep width vernier throughout its range from one-third to fully CW with a position shift of no more than 0.2 cm.

Using the 1000 MHz marker as a reference, alternately adjust WSWL R-159 and WSCF R-161 to place the 800 MHz and 1200 MHz markers at the extremes of the oscilloscope trace, as shown in Figure 4-19D. Check for shift in position of the 1000 MHz marker as the sweep width vernier is rotated, and readjust if necessary, as previously described.

4-19.2 Adjustment of Wide Sweep Width - LOW Band.

With the controls positioned as described in the preceeding sub-paragraph, turn the sweep width selector to NARROW, and adjust the sweep width vernier to expand the marker to the shape shown in Figure 4-19E. Slowly adjust the center frequency dial to place the marker at the center of the oscilloscope trace.

Set the band switch to LOW, and adjust the center frequency dial about the 300 MHz graduation (red scale) until the 300 MHz marker appears at the center of the oscilloscope trace.

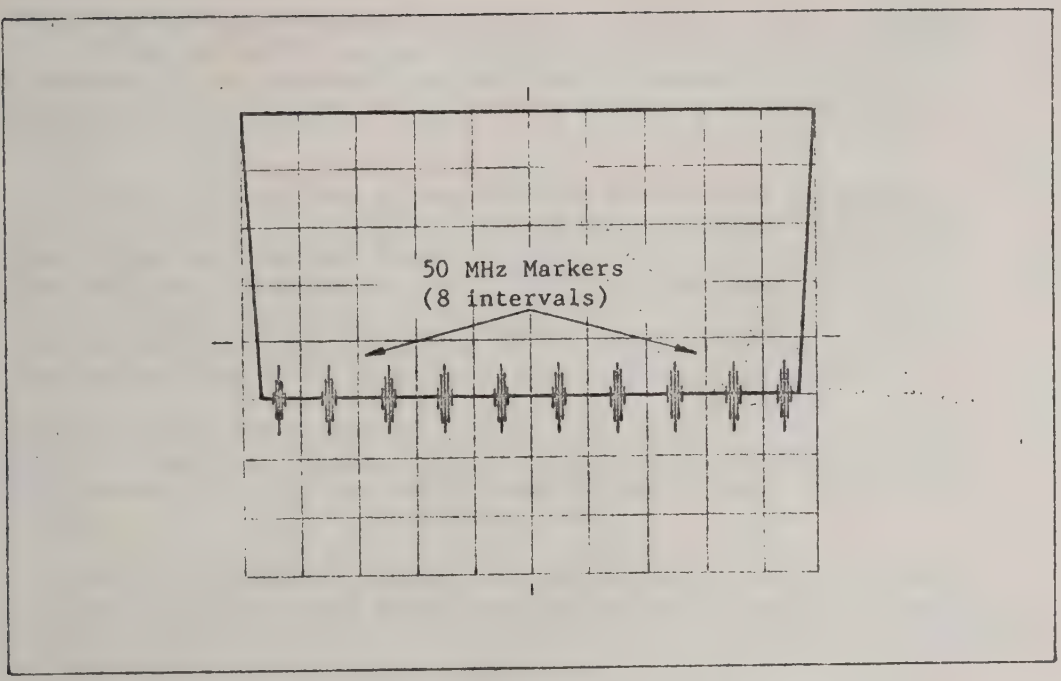



Figure 4-19.C Initial Adjustment of Sweep Width

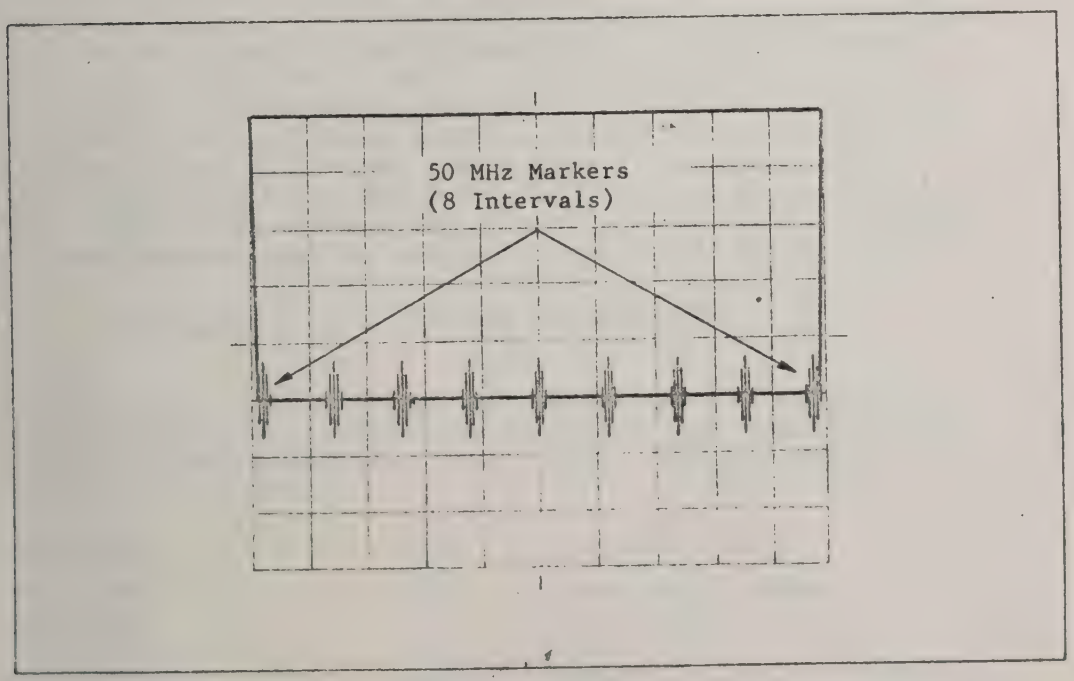



Figure 4-19.D Final Adjustment of Sweep Width

Note any deviation from an indication of 300 MHz on the frequency dial. If the deviation exceeds the width of the line which defines the graduation, an adjustment of the fixed frequency oscillator is indicated. If this is the case, proceed as directed in paragraph 4-15.

Tune the frequency dial to the vicinity of the zero graduation (red scale), and place the center of the beat-frequency notch in the center of the oscilloscope trace. Note any deviation from the zero graduation when the notch is in the center of the trace. If the deviation exceeds the width of the line of the graduation, alternately adjust the zero and 300 MHz points of the fixed frequency oscillator to obtain the best match with the graduations at these points.

Set the sweep width control to WIDE, and rotate the sweep width fully CW. Tune the frequency dial to place the beat-frequency notch at the extreme left of the oscilloscope trace, as shown in Figure 4-19F.

Alternately adjust the center frequency dial and low band sweep width potentiometer (LBSW) R-163 to place the zero and 300 MHz markers at the extremes of the oscilloscope trace, as shown in Figure 4-19G.

This completes calibration of the sweep drive.

4-20. Sweep Linearity.

Sweep linearity will be determined at maximum sweep width in the HIGH band. A sweep of 400 MHz will be presented, together with frequency markers at each 50 MHz of sweep width. This sweep of frequency will be distributed over 8 cm of the horizontal axis of the oscilloscope. Each vertical graticule will represent an increment of 50 MHz if the total sweep width is linearly interpolated. The maximum deviation of a marker from a vertical graticule will be measured using the 0.2 cm sub-graduations on the principal horizontal axis. These sub-graduations will have a value of 10 MHz. The percent non-linearity will be calculated using the following formula:

$$\text{Non-linearity (\%)} = \frac{\text{Maximum deviation (MHz)}}{400 \text{ MHz}} \times 100$$

Connect the instrument to an oscilloscope and a RF detector, as shown in Figure 4-20A. Adjust the controls of the oscilloscope to display a pattern as shown in Figure 4-20B. Set the controls of the instrument as follows:

| | | | |
|---|---|---|---|
| Band switch . . . . . | HIGH | Frequency dial . . . . | 1000 MHz |
| Sweep width . . . . . | WIDE | Sweep width vernier . . . . | CW |
| Attenuator . . . . . | 0 DB | RF vernier . . . . . | CW |
| Sweep rate . . . . . | LINE | Marker . . . . . | HM-50 MHz |

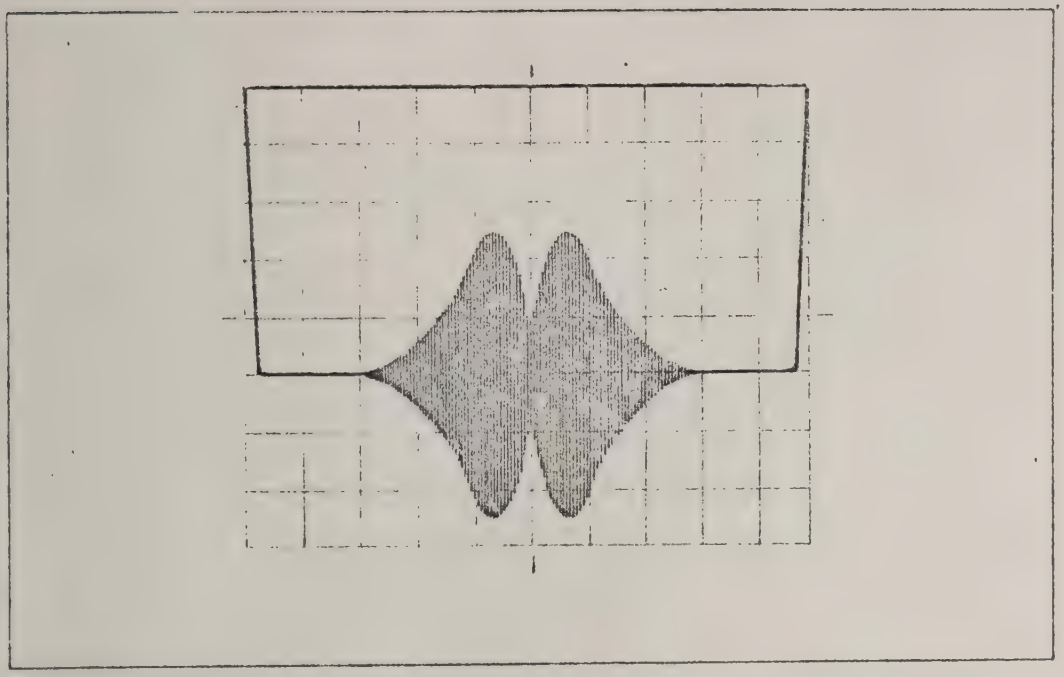


Figure 4-19.E Display of birdie at NARROW sweep width

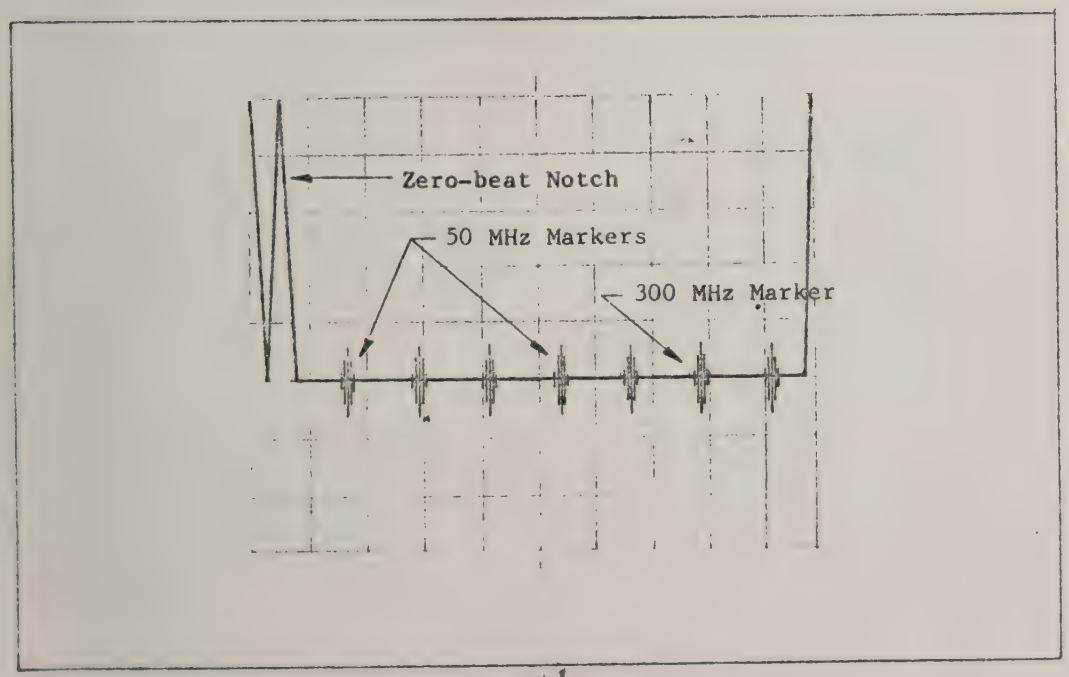



Figure 4-19.F Placement of Zero-beat Notch

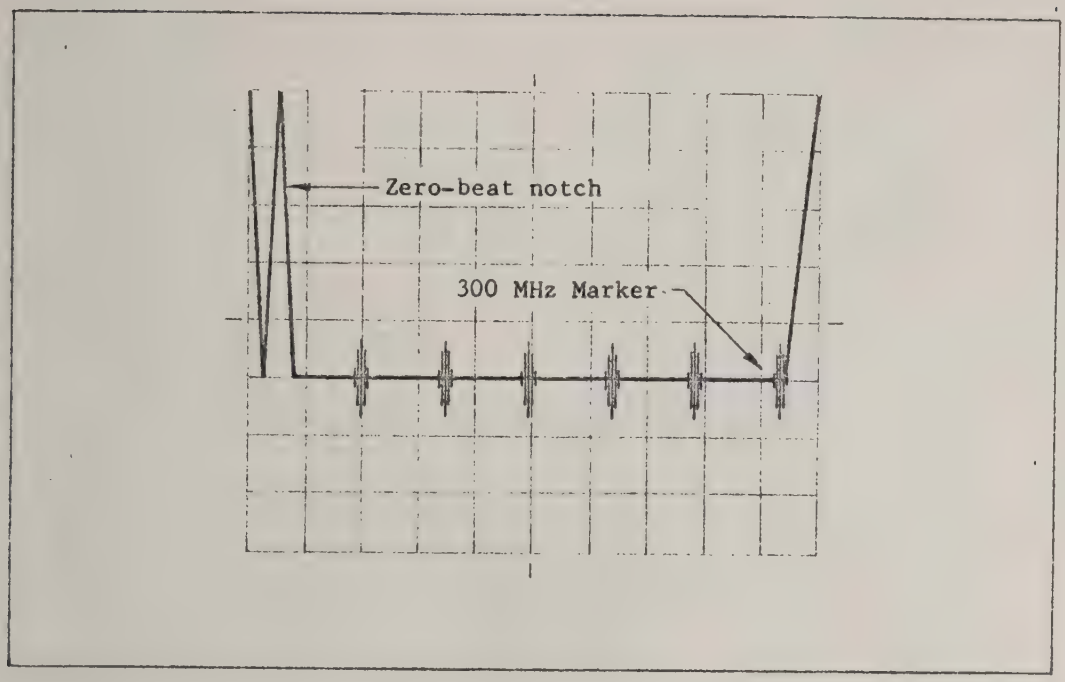



Figure 4-19.G Display of Sweep Width-LOW Band

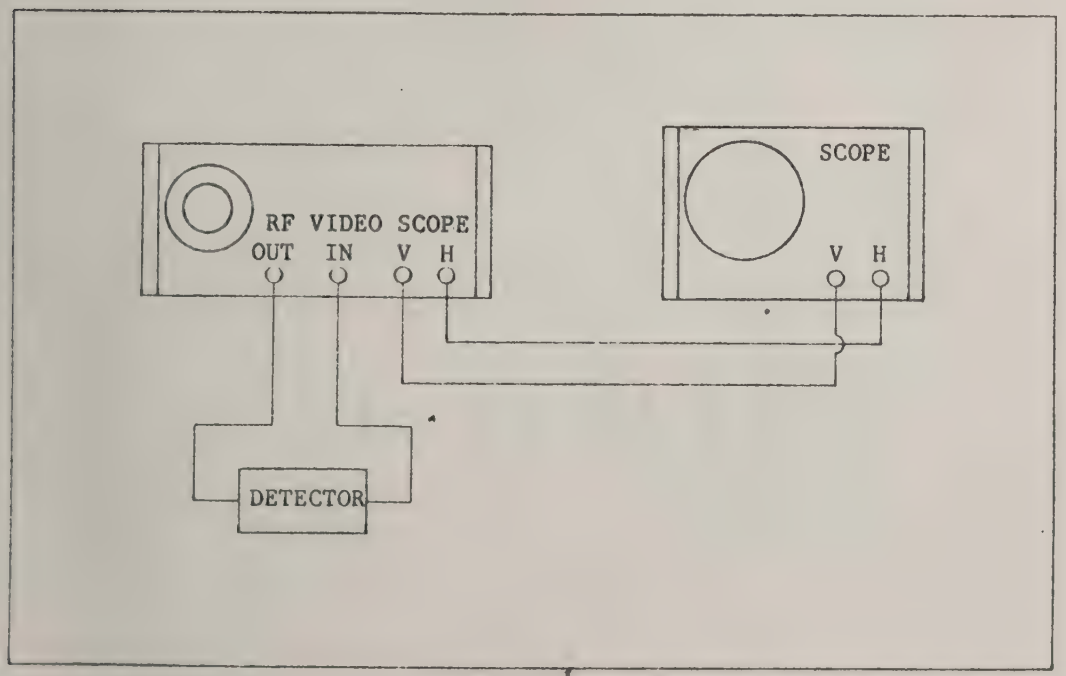



Figure 4-20.A Test Set-up to Determine Sweep Linearity

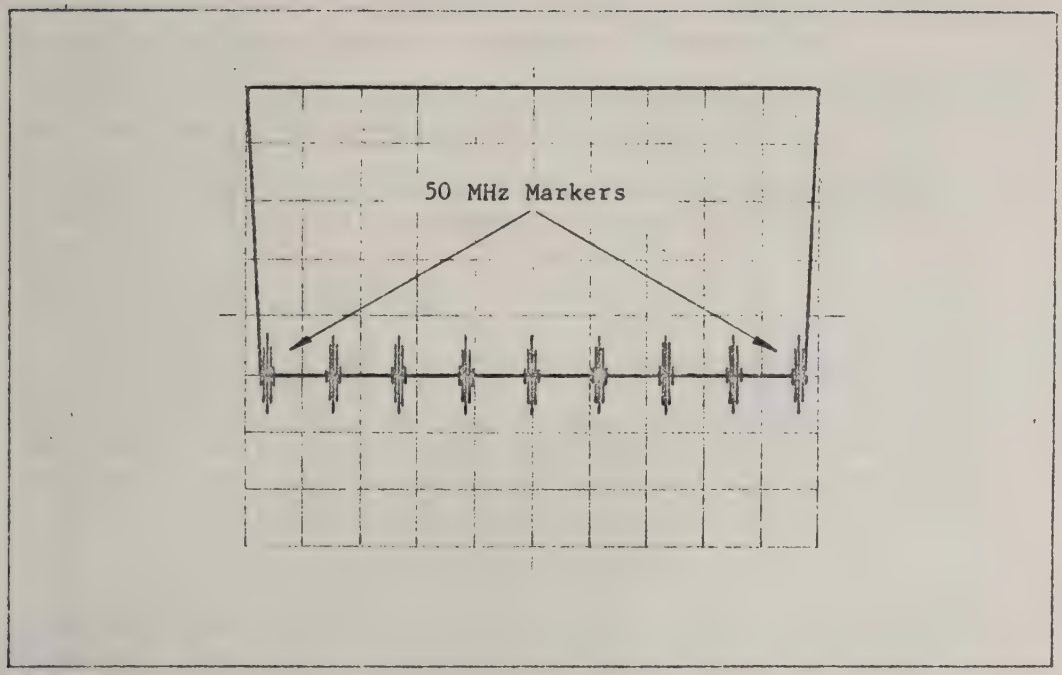



Figure 4-20.B Preliminary Display for Sweep Linearity

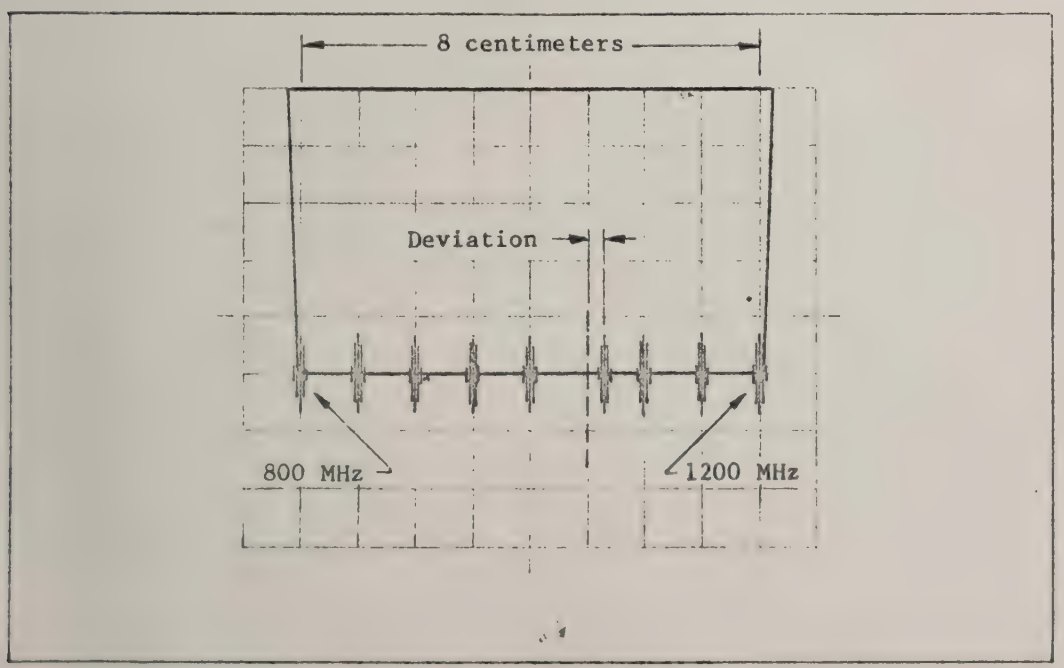



Figure 4-20.C Display Adjustment for Sweep Linearity

Adjust he oscilloscope controls to place the 800 MHz and 1000 MHz markers at the fourth graticule to the left and right respectively of the center vertical graticule, as shown in Figure 4-20C.

Determi e the maximum deviation of any marker from a vertical graticule, and xpress this deviation in terms of frequency.

Calcula e the percent non-linearity, using the formula presented in the fir t part of this paragraph. The non-linearity shall not exceed 5%.

4-21. Atte nuator calibration.

The atte uators of the Texscan line of sweep generators are calibrated as c mponents before assembly into an instrument. This calibration is carried out at 30 MHz, 500 MHz, and 1000 MHz. Due to the power level s and frequencies involved, precision micro-wave attenuation mea ring equipment is required to evaluate these components. No quantit ive "self-checking" procedure is recommended.

4-22. Int nal Marker Preamplifier Adjustment.

The amp tude of individual plug-in birdie markers may be adjusted by potentic eters R-305, R-306, R-311, R-312, R-317, R-318, R-324, R-325.

# CHAPTER 5. THEORY OF OPERATION

## Section I. FUNCTIONAL DESCRIPTION

### 5-1. Block Diagram.

Figure 5-1 is a Block Diagram of circuit functions. Front panel controls associated with the operation of the various circuit functions are shown in balloons. Input and output connectors are shown along the right and left hand margins.

### 5-2. Rate Circuit.

The sweep of frequency is under control of the rate circuit. A square wave is produced to define the period of the sweep. Each period consists of a display and a blanking interval. During the display interval the square wave is integrated to generate a triangular wave (a sawtooth). This triangular wave is in phase with the square wave, and the ramp of voltage which this wave represents serves as the instruction for the ramp of frequency during sweep.

### 5-3. Sweep Drive Circuit.

This is an interfacing circuit which accepts the linear voltage ramp from the rate circuit, and shapes this waveform to compensate for the non-linearities of the frequency modulating system.

### 5-4. Variable Frequency Oscillator.

The frequency of this oscillator is varied by two inputs. The sweep of frequency is produced by varying the capacitance of the voltage variable diode which is a part of the resonant circuit. The center frequency is determined by varying the electrical length of a tuned line, which is the principal inductive element of the resonant circuit. In the case of the single band model VS-70 (290 - 1200 MHz) these elements constitute the RF generation system. The two band extended range model VS-80 (1 - 1200 MHz) employs the same RF system in the band of frequencies from 290 - 1200 MHz. The extended range (1 - 300 MHz) is obtained by heterodyning this variable frequency oscillator with a fixed frequency signal of 700 MHz, suppressing this carrier, filtering to recover the lower side-band, and amplifying to the required RF level.

5-5. Fixed Frequency Oscillator.

The two band extended range model VS-80 employs a 700 MHz fixed frequency oscillator and a balanced bridge mixer to convert the 290 - 1200 MHz variable frequency oscillator to the 1 - 300 MHz band. The balanced bridge diode mixer suppresses the 700 MHz carrier, and a low-pass filter removes the higher frequency components of the signal.

5-6. Video Amplifier.

The lower side-band product of the mixing process represents a power level substantially lower than that of the original signal components. A wide-band staggered video amplifier is employed to raise the lower side-band to the required RF output level.

5-7. Band Switch.

In the case of the extended range model VS-80, a coaxial switch routes the RF signal from the variable frequency oscillator either directly to the output attenuator, or through the mixer-amplifier system.

5-8. Monitor.

The monitor samples and detects the RF output voltage, and provides a feedback signal for the closed loop level control system.

5-9. ALC Switch.

The ALC switch selects either the feedback signal from the internal monitor, or a signal from an external monitoring device.

5-10. Attenuator.

The attenuator provides from zero to 70 DB of attenuation of RF output, in 10 DB steps. (A second attenuator is available as an option, which provides zero to 10 DB of attenuation, in 1 DB steps.)

5-11. Sweep Sample Divider.

An undetected sample of the RF output is taken at the monitor, and divided for the internal and external "birdie" marker systems.

5-12. External Marker Mixer.

The external marker mixer accepts an input from an external marker generator, and mixes this with a sample of the RF output.

5-13. Plug-in Markers.

Provision is made for the use of up to eight plug-in markers of either the single frequency (SF) or harmonic (HM) type. These markers mix a signal with a sample of the RF output, and deliver a band of frequencies from approximately zero to 100 KHz, which constitutes the "birdie" marker.

5-14. Birdie Marker Preamplifier.

The birdie marker preamplifier raises the level of the signal from the internal marker generators.

5-15. Birdie Marker Amplifier.

The marker signal from the external marker mixer is adjusted in level by a front panel control, and the signal from the internal marker generators is adjusted in level by individual internal controls. Either or both of these inputs are applied to the birdie marker amplifier. The bandpass of this amplifier is adjustable by a front panel control (marker shape). This determines the shape or width of the birdie marker. A potentiometer on the front panel acts as a voltage divider on the amplifier output, and governs the amplitude or size of the birdie marker.

5-16. RF Level Control.

The RF level control compares a reference voltage from the RF vernier with the feedback signal from the monitor, and regulates the power input to the variable frequency oscillator or video amplifier to level the RF output. A blanking signal from the blanking generator over-rides the level control signal during retrace of sweep, and blanks the vertical output to the external display device by removing the power from the RF system.

5-17. Video Blanking.

An alternate mode of blanking may be selected by an internal switch. In this mode, the power supply to the RF system is not interrupted, but the blanking signal switches a field effect transistor which grounds the vertical output to the display device during retrace of sweep.

5-18. Blanking Generator.

The blanking generator accepts the square wave blanking instruction from the rate circuit, and supplies the drive for RF or video blanking.

5-19. Video Input.

A front panel connector accepts the detected RF signal from the device under test, provides for superimposing the "birdie" markers, and presents the identified signal at the oscilloscope vertical output connector.

## Section II. DETAILED CIRCUIT DESCRIPTION

5-20. Schematic Diagrams.

For convenience, the schematic diagrams have been provided as fold-outs at the rear of the manual. Each diagram may be opened out, where it remains in front of the reader as the text is followed. The diagrams are divided into the following sections:

| | |
|---|---|
| Power supplies | Figure 5-2 |
| Control circuits | Figure 5-3 |
| RF circuits | Figure 5-4 |
| Frequency marker circuitry | Figure 5-5 |
| Options | Figure 5-6 |

5-21. Power Supplies.

5-21.1 +200 V DC Regulated Supply. The input to the +200 V DC supply is obtained from transformer T-1. The secondary of this transformer is center tapped and grounded. The resulting windings provide two outputs 180° out of phase. Diodes CR-1 and CR-4 supply a full wave rectified input to the regulating system. Capacitors C-1A and C-1B, together with R-17 comprise a capacitor input pi filter. The filtered output is series regulated by-pass transistor Q-9, and appears across the voltage divider network consisting of R-20, R-21, and R-23. A part of the voltage appearing across this divider is applied to the base of transistor Q-11, where it acts as a measure of the regulated output voltage. The emitter of Q-11 is held at a substantially constant voltage by gaseous discharge tube I-2. The difference between the constant voltage emitter and the voltage at the base, which is a sample of the regulated output, determines the forward bias of this transistor, and the amount of current passed through load resistor R-18. The voltage supplied to R-18 is clamped at 18 volts above the regulated output by Zener diode VR-7. The voltage at the collector of Q-11 is applied to the base of Q-10, which is in a Darlington connection with pass transistor Q-9. When an operating point has been established for Q-9 by the setting of the output voltage adjusting resistor R-19, a nominal regulated output voltage results. Should the output voltage tend to increase, there will be an increase in forward bias on Q-11, and more current will be passed by R-18.

The voltage at the collector of Q-11 will decrease, and this decrease will be reflected at the base of Q-9 as a decrease in forward bias. As a result, the voltage drop across Q-9 will increase, which operates to offset the transient which caused the increase in output voltage. Due to the amplification of this system, the output voltage is held within close limits with changes in load. Capacitor C-14 improves the regulation, and contributes to the stability of the feedback system by decreasing the gain and total output impedance at higher frequencies. The remaining circuit components develop the required performance of the overall system.

5-21.2 + 30 V DC Regulated Supply.

The input for the +30 V DC supply is obtained from the secondary of transformer T-1. The input is rectified by diodes CR-2 and CR-6; filtered by C-1D, series regulated by-pass transistor Q-1, and appears across the voltage divider consisting of R-5, R-7, and R-8. The regulating circuit of this power supply operates in substantially the same way as the circuit of the +200 V DC supply, previously described. However, Zener diode VR-3 and temperature compensation diode CR-7 provide the reference voltage for the error amplifier Q-4. In addition, a pre-regulator has been added in the form of Q-2. The base of Q-2 is held at a constant voltage by the Zener diode VR-1, and this transistor becomes a constant current source for the error amplifier Q-4. To protect the series pass transistor Q-1, current limiting has been incorporated, consisting of R-3 and Zener diode VR-2. Zener diode VR-2 monitors the voltage drop represented by the base-emitter potential of Q-1 and Q-3 plus the output current through R-3. When this voltage drop exceeds 7 volts, the Zener breaks down and clamps the base of Q-3, preventing the application of additional drive to the base of the pass transistor Q-1. The base-emitter potential of Q-1 and Q-3 is approximately 0.6V each, or a total of 1.2V. At a current of 323 mA the drop across R-3 will exceed 5.8V, and the Zener will break into conduction (1.2V + 5.8V = 7V). Under these conditions the base of the pass transistor will be clamped at approximately 35.2V.

5-21.3 -30 V DC Regulated Supply.

The input to the -30 V DC supply is rectified by diodes CR-3 and CR-5. The output of these rectifiers is negative with respect to ground. The function of the regulating circuit is substantially the same as that of the +30 V DC supply, previously described. However, the semiconductors have a complementary configuration, due to the difference in polarity.

5-21.4 +50 V DC Regulated Supply.

The input to the unregulated +50 V DC supply is obtained by bleeding the rectified input of the +30 V DC supply. Capacitors C-1C, C-2, and resistor R-1 act as a smoothing filter.

5-21.5 LINE Synchronizing Signal.

Pulses for synchronizing the LINE mode of sweep rate operation with the power line frequency are obtained across Zener diode VR-8.

5-22. Control Circuits. (Figure 5-3)

5-22.1 Rate Circuit.

The rate circuit consists of a Schmitt Triger, which generates a square wave, and a Miller integrator, which integrates the square wave to produce a triangular (sawtooth) wave. In the VARIABLE mode of sweep rate, the output of the Miller integrator is fed back to the Schmitt trigger. Due to the hysterisis characteristics of the Schmitt Trigger, a free-running mode of operation results, similar to a relaxation oscillator. The Schmitt Trigger consists of transistors Q-101 and Q-102, together with the feedback network R-110, R-113, and R-114. Assume as an initial condition, that the emitter of Q-101 is at -15.7 volts, the base is forward biased, but being driven in a negative direction by feedback from the Miller integrator, and that Q-101 is conducting and saturated. As the base is driven in a negative direction, it will approach the voltage at the emitter of -15.7 volts, and a point will be reached where conduction through Q-101 decreases, the voltage at the collector rises, and this rise in potential is reflected at the base of Q-102. Conduction is initiated in Q-102, and transistors Q-101 and Q-102 switch states regeneratively, due to the feedback network between them, with Q-102 now conducting, and Q-101 cut-off. This results in the generation of a step function at the collectors of these transistors. When Q-102 turns ON, the current through the common resistor R-110 causes the voltage at the emitter of Q-101 to move away from the - 30 V supply, and it goes to approximately - 6.1 V. As a result, the voltage at the base of Q-101 must be raised from - 15.3 volts to above - 6.1 volts before Q-101 will be forward biased, and another change in state can take place. The time required for the feedback from the Miller integrator to make this excursion of voltage defines the sweep display interval.

With Q-102 now conducting, the voltage at the collector goes low and is clamped to - 5.6 V by Zener diode VR-101. The charge accumulated on the integrating capacitors C-102 and C-103 while the collector was high will leak away through R-118 and R-120B or R-117 and R-120C, depending on the rate selected by switch S-103-2B. As this charge leaks away, the voltage at the base of Q-103 (the input of the Miller integrator) decreases from approximately + 2.3 V to + 2.1 V. This negative going signal is amplified and inverted by Q-104 (the output stage of the Miller integrator) and appears as a positive going signal at the collector. This voltage starts very close to ground, rises to approximately + 19.5 V, and is fed back to the base of Q-101 through R-102, R-101, and R-105. As a result, the voltage at the base of Q-101 begins to rise, and when it reaches

a value exceeding the potential of - 6.1 V at the emitter, Q-101 will be forward biased, and conduction will be initiated. Q-101 and Q-102 will again regeneratively change state. With Q-102 cut-off, current decrease in the common resistor R-110 will cause the emitter of Q-101 to go low, to approximately - 15.7 V. With the base at - 5.6 V, another interval of time will be required for the feedback from the Miller integrator to drive the base back down to - 15.3 V, so that another change in state can take place. This interval of time defines the blanking period, or retrace of sweep.

With Q-102 now cut-off, the voltage at the collector goes high, to approximately + 29.3 volts. Integrating capacitors C-102 and C-103 may now charge through their respective timing networks. As these capacitors charge, the voltage at the base of Q-103 rises, from approximately + 2.1 V to + 2.3 V. This positive going signal is amplified and inverted by Q-104, and fed back to the base of Q-101. This drives the voltage at the base of Q-101 down to - 15.3 V, at which point another transition takes place, and the cycle is repeated.

The triangular waveform of voltage appearing at the collector of Q-104 serves as the basic instruction for the sweep of frequency and the horizontal deflection of the external display device.

Front panel selector switch S-103, identified "Sweep Rate", selects the type of sweep rate instruction signal to be employed. In the VARIABLE position, two combinations of RC are selected for the input of the Miller integrator. In the LINE position, trigger amplitudes and D.C. levels are selected which permit synchronization with power line frequency, and amplitude excursions of the triangular waveform which coincide with operation in the VARIABLE mode. In each of these cases, the output of the Miller integrator is routed to buffer amplifier Q-105. In the MANUAL position, the rate circuit outputs are disconnected from the buffer amplifier Q-105 and the blanking amplifiers Q-109 and Q-204. Instead, a manual sweep and deflection instruction is provided by potentiometer R-120A. This instruction is obtained by dividing the + 30 V power supply. The excursion of voltage provided between the CCW and CW positions of this potentiometer serve as the reference for the sweep drive instruction. The amplitude and D.C. level of the triangular waveforms obtained in the LINE and VARIABLE modes of sweep rate operation are adjusted to coincide with the voltage excursion obtained from R-120A.

Transistor Q-105 is a buffer amplifier which accepts the basic sweep drive instruction, and provides outputs which can be adjusted in amplitude and D.C. level, and serve as inputs to the sweep drive or linearity amplifiers, and supply the horizontal deflection signal for the external display device.

A typical excursion of voltage at the emitter of Q-105 would be from 0.2 V to + 19.5 V. This excursion of voltage is adjusted in D.C. level by R-168 and R-169, and serves as the horizontal output voltage.

5-22.2 Sweep Drive (Linearity Circuit).

Figure 5-7 is a graphical representation of the function of the sweep drive circuit. The horizontal axis represents the sweep width, while the family of curves presented show the voltage drive required to produce a linear dF/dt at various sweep widths. Since the sweep drive instruction from the rate circuit is a linear triangular wave, additional signal processing is required to achieve the desired result.

An examination of this family of curves reveals that at narrow sweep widths, the waveform of voltage is almost linear. As sweep width is increased, the drive voltage at the lower frequencies is almost linear, but increases abruptly as the frequency increases. This suggests that the required waveform of voltage could be obtained at the various sweep widths by allowing the sweep width control to vary the mixture of a linear and non-linear drive signal. This is essentially the mechanism employed in the sweep/drive/linearity circuit.

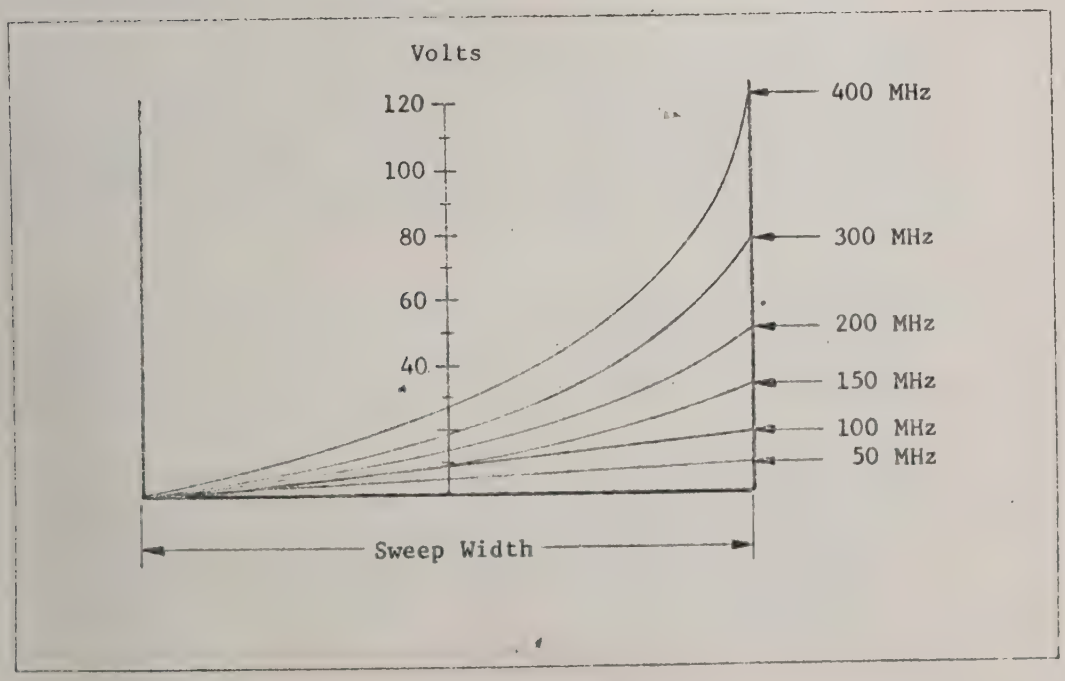



Figure 5-7. Drive Voltage vs. Sweep Width

Transistor Q-106 is the linear amplifier. This is a grounded base amplifier, and the drive instruction is applied to the emitter. The output of this amplifier will be the predominant drive signal in the low and medium sweep widths. Potentiometer R-131 determines the level of the input signal to this amplifier, and, accordingly, sets the center frequency in the medium sweep width.

Transistor Q-107 is the non-linear amplifier. This, also, is a grounded base amplifier. Potentiometer R-159 acts as a voltage divider, and determines the magnitude of the drive signal applied to the emitter of this amplifier. This sets the maximum amount of drive instruction applied to the non-linear amplifier. Since the output of this amplifier is the predominant drive signal in the wide sweep width, this potentiometer sets the maximum sweep width. Potentiometer R-161 adjusts the D.C. level of the base of Q-107, and sets the center frequency in the wide sweep width.

Potentiometer R-164 is the front panel control which varies the sweep width. It is a two section potentiometer, and it controls the mixing of the linear and non-linear drive signals.

Potentiometer R-167 introduces an off-set voltage which controls the center frequency in low sweep widths.

Variable resistor R-163 attenuates the output of the non-linear amplifier in the low band of frequencies, and operates to set the sweep limit in the LOW band.

5-22.3 RF Level Control Circuit.

RF level control is effected by varying the power supply to the variable frequency oscillator when in the HIGH band of frequencies, and by varying the power supply to the video amplifier when in the LOW band of frequencies. This is a closed loop regulating system which compares a reference signal with a feed-back signal which is a measure of RF output, and adjusts the power input so as to null this error signal.

Pass transistor Q-201 is a series regulator which responds to a control signal applied to the base. The control signal is obtained from Q-202, which is the pass transistor driver. The instruction for the pass transistor driver is obtained from the error amplifier consisting of Q-206 and Q-207.

The error amplifier is essentially a D.C. bridge. R-206 and R-207 constitute two elements of the bridge, and Q-206 and Q-207 may be considered variable elements of the bridge. A reference signal is applied to the base of Q-207 by potentiometer R-208, which is the front panel control, RF VERNIER. The maximum and minimum values of this reference signal are established by the settings of R-209 and R-210, which are the RF MAX and MIN controls

which extend through the front panel. A feedback signal obtained from either the internal monitor or an external monitoring device is applied to the base of Q-206. The voltage at the collector of Q-206 will be a measure of the difference between the reference and feedback signals. The reference and feedback are negative signals. An increase in RF output will be reflected as an increase in negative potential at the base of Q-206, which is a PNP device. The conductance of Q-206 will increase, which will result in a positive going signal at the collector. This positive going signal is applied to the base of Q-202. The inverted signal at the collector of Q-202 is applied to the base of Q-201, where it operates to decrease the conductivity of Q-201, resulting in a lowered output power to the oscillator system. This lowered power operates to offset the transient which resulted in an increase of RF output.

Transistor Q-203 is shunted across the pass transistor driver Q-202. This shunt transistor is not a part of the level control system, but operates to over-ride the control action of Q-202 by driving the base of Q-201 to a negative level when Q-203 is saturated. This cuts off Q-201, and blanks the RF output when in the RF blanking mode.

5-22.4 Blanking Circuit.

The blanking instruction is obtained from the rate circuit. A square wave is present at the collector of Q-102, the output of the Schmitt Trigger. It will be recalled that the collector of Q-102 is low during the display period. This signal is routed to the blanking generators Q-204 and Q-109 through S-103, S-101, and S-102. These switches determine when the blanking signal is to be effective, and the blanking mode to be employed, i.e., RF or VIDEO blanking.

In the VIDEO blanking mode, the low signal at the collector of Q-102 is routed to the gate of Q-109, an N channel FET. The low signal permits the bias from the - 30 V supply to develop a field which "pinches-off" the FET, resulting in a high impedance across the vertical output at connector J-309. Conversely, when the signal at the collector of Q-102 is high, the potential at the gate of Q-109 is driven nearly to zero, and the low intrinsic resistance of the FET shunts the vertical output to ground, resulting in a blanked output.

When switch S-102 is in the RF blanking position, the signal at the collector of Q-102 is presented to the base of Q-204. When the collector of Q-102 is low (display interval), Q-204 is cut off, and this drives Q-203 into cut-off, permitting Q-202 to level the power supply to the oscillator circuitry. Conversely, when the collector of Q-102 is high, Q-204 and Q-203 are saturated, driving Q-201 into cut-off, and blanking the RF output.

The availability of two modes of blanking may seem redundant. However, each mode has its advantages. Higher oscillator stability may be enjoyed in the VIDEO mode of blanking, since transients are associated with switching the power supply ON and OFF. On the other hand, if the instrument is used with logarithmic amplifiers, the off-set voltages usually employed with these devices are not completely blanked by the FET, and the baseline does not return to zero during the blanking interval.

5-23 RF Circuits (Figure 5-4).

5-23.1 Variable Frequency Oscillator (VFO).

The VFO is a tuned line - varactor swept microwave oscillator, with a frequency range of 300 MHz to 1200 MHz. The center frequency may be varied from 300 MHz to 1000 MHz. This range is limited by mechanical stops on the tuned line. The varactor diode is capable of sweeping the unit to 1200 MHz in the wide sweep mode.

Transistor Q-501 is an amplifier which supplies energy to the resonant circuit to sustain oscillation and develop the RF output. An analysis of the operation of this circuit requires consideration of the junction capacitances and other distributed parameters of the circuit, as well as the "de-Qing" of mechanical configurations required in the execution of the circuit, and which may become resonant at some point in the broad spectrum in which the instrument operates. For this reason, the discussion of the VFO will be limited to the inputs and outputs the operator may be called upon to examine.

The power input to the oscillator is selected by switch S-601-3B. In the HIGH band of frequencies the VFO independently supplies the RF output. Switch S-601-3B routes the leveled and blanked power supply to the oscillator through dropping diode VR-501 in this mode of operation. In the LOW band of frequencies, switch S-601-3B routes the regulated + 30 V supply to the oscillator, through diode VR-501 (in the LOW band the RF output is blanked and leveled at the video amplifier).

The varactor drive voltage (sweep drive) is routed to the cathode of the varactor diode through L-501, which isolates the drive input from the RF of the oscillator. Likewise, capacitor C-501 isolates the varactor drive from the collector voltage (D.C.) of Q-501.

The RF output is obtained by proximity coupling of the loop consisting of R-501, R-507, and R-500. (The coupling loop represented by these resistors is a developed configuration, not completely represented by the lumped parameters shown.) The RF output available at oscillator connector J-501 is filtered by FL-501 to reduce harmonic distortion.

5-23.2 Fixed Frequency Oscillator (FFO).

The fixed frequency oscillator is, also, of the tuned line type. It operates at a nominal frequency of 700 MHz. It is heterodyned with the output of the VFO. The lower sideband of this mixing process constitutes the LOW band of frequencies from zero to 300 MHz.

Transistors Q-551 and Q-552 supply the energy for the RF output. The output frequency is tunable over a narrow range by variable capacitor C-553. The adjustment control is available from the outside of the oscillator enclosure.

Balanced RF outputs are obtained by the coupling loop consisting of R-554 and R-555. (As was the case of the VFO, this coupling loop is a developed configuration, not entirely represented by the lumped parameters shown.)

A balanced diode mixer heterodynes the output of the VFO and the FFO, suppressing the fundamental of the FFO. Lowpass filter FL-551 cuts-off at 300 MHz, removing the upper sideband of the mixing process. The lower sideband is coupled to the video amplifier.

5-23.3 Video Amplifier.

The lower sideband of the mixing process represents a power level substantially below that of the original signals heterodyned. A wideband amplifier is employed to raise the level of the lower sideband to a value comparable to that of the HIGH band.

Transistors Q-401, Q-402, Q-403, and Q-204 constitute the video amplifier. The response of the four stages is staggered with respect to frequency to provide a flat output from 1 MHz to 300 MHz. Capacitors C-402, C-408, C-415, and C-422 are adjustable, and are used to level the gain of the four stages.

In the RF mode of blanking, the power supply is switched ON and OFF to the first three stages of the video amplifier. The power supply to the last stage is not switched, to improve oscillator stability.

5-23.4 Band Switch.

Coaxial switch S-601 is a front panel control which determines the range of frequencies available at the RF output connector.

In the HIGH band of frequencies, S-601 routes the output of the VFO directly to the monitor.

In the LOW band of frequencies, S-601 routes the output of the VFO to the mixer, and applies the output of the video amplifier to the monitor.

5-23.5 Monitor, Sweep Sample Divider, and External Marker Mixer.

This assembly accepts the output from the band switch, and performs the following functions:

(1) A sample of the RF output is detected by diode CR-601, and routed to minitor selector switch S-201.

(2) A sample of the RF output is divided by resistor network R-603, R-604, R-605, and R-606 to provide signals for the birdie marker system.

(3) One sample of the RF output from the above divider network is mixed with a signal from the external marker generator by diode CR-602, and routed to the birdie marker amplifier.

(4) Two samples of the RF output from the divider network are routed to the plug-in markers by means of coaxial cables.

(5) The point at which the RF output is sampled by the monitoring diode CR-601 becomes a constant voltage-zero impedance point. The source impedance of the RF output is defined by the 50 ohm resistor R-602.

(6) The RF output of this assembly is presented at connector J-607.

5-23.6 Attenuator.

The RF output of the monitor assembly is routed to front panel attenuator assembly Z-603. This is a turret type attenuator providing from zero to 70 DB of attenuation in 10 DB steps, while maintaining a constant impedance of 50 ohms, properly terminated.

5-24 Frequency Marker Circuitry. (Figure 5-5)

5-24.1 Plug-in Markers.

Each frequency marker has a unique circuit, depending on the frequency range and the type of output, i.e., whether the marker is of the single frequency or harmonic type. In general, these markers consist of a microwave oscillator, a mixing system, and an audio amplifier.

The plug-in markers should be considered an accessory item, not necessarily a part of the instrument, and the number and type will vary from instrument to instrument, and may be retro-fit at any time. For specific information, consult the literature accompanying these accessories.

5-24.2 Plug-in Marker Pre-amplifier.

The plug-in marker pre-amplifier consists of four independent stages, each handling two of the plug-in marker generators. Transistors Q-301, Q-302, Q-303, and Q-304 are the pre-amplifying transistors. The operation of each stage is identical, and only the first stage will be described. However, the four stages do have a common load resistor, R-301, and the signal at the collectors will reflect the summed current of all the stages.

Transistor Q-301 is a common emitter amplifier, with R-301 as the load resistor. D.C. bias is established by current feedback resistor R-302, and voltage feedback is obtained by R-307.

Audio Frequency signals up to approximately 200 KHz from the plug-in marker generators are applied to the base of Q-301 through the size control potentiometers R-305 and R-306. The latter feature permits marker frequency identification by amplitude.

The composite signal from the marker generators is coupled to the input of the "birdie" marker amplifier through capacitor C-313.

5-24.3 Birdie Marker Amplifier.

The input stages of the birdie marker amplifier consist of Q-305 and Q-306. Q-305 handles the input from the plug-in marker system, while Q-306 accepts the input from the external marker mixer. The magnitude of the input signal from the external marker generator is determined by R-331, a front panel control. Q-305 and Q-306 have a common load resistor, R-327, where the two marker signals may be added. The output of Q-305 and Q-306 is applied to the frequency attenuating network consisting of R-334, 342, 343, 335, C-307, 308, 316, 317, 310, 309, and L-301. The lowpass characteristics will be determined principally by the coupling capacitors, while the higher frequencies may be attenuated by the setting of R-335, a front panel control identified, "marker shape".

The signal at the collector of Q-307 is applied across the dividers R-339A and R-339B, which control the amplitude of the signal superimposed on the detected RF output applied at the video input connector J-310, and delivered to the scope vertical output connector J-309.

5-24.4 Sweep Sample Terminations.

The two samples of RF output supplied to the plug-in markers are terminated by 50 ohm loads mounted on the rear panel of the instrument.

# CHAPTER 6. MAINTENANCE

## Section I. GENERAL

### 6-1. Scope.

Field repair or replacement of the RF assemblies is not recommended. These assemblies require particular techniques in component installation, and physical positioning is critical. While individual assemblies are replaceable, considerable post-installation adjustment is required to produce specification performance. The nature of this work involves "know-how" which is the result of experience, and it is unlikely that it would prove economical to develop this experience in the field.

The maintenance section will be devoted primarily to the detection and isolation of difficulties. When it has been established that the difficulty is associated with the power supplies, control circuitry, or low frequency marker systems, the action to be taken will be obvious, and it will be assumed that a level of skill exists which obviates the need for step-by-step instructions in component replacement. When a RF assembly has been found deficient, based on an examination of inputs and outputs, it is recommended that the instrument be returned to the manufacturer for repair.

### 6-2. Preparation for Maintenance Work.

Before attempting to trouble-shoot or repair the instrument, the technician should become familiar with the material of Chapter 4 and 5.

## Section II. TROUBLE-SHOOTING

### 6-3. Approach to Trouble-shooting.

When a deficiency in instrument performance becomes evident, the first step to be taken is to adequately identify the nature of the deficiency. If the instrument is operating, but not delivering the required performance, the adjustment procedures described in Chapter 4 should be undertaken. On the other thand, if an output is absent, the schematic diagram should be consulted to determine what circuits contribute to the production of this output, and the circuitry traced back from the point of evident deficiency.

In circuit tracing, the greatest amount of information can be gleaned with the least amount of effort by checking the terminals of the active devices, primarily the transistors. If the instrument can be energized without evidence of incipient damage, the outputs of the transistors associated with the suspected circuit should be checked. These outputs will be of two types, namely, static and dynamic. Static outputs should be checked with a high impedance voltmeter, using chassis ground as a reference. Dynamic outputs should be checked using an oscilloscope. In making the latter tests, normally the internal time base system of the oscilloscope would be employed for the horizontal deflection. However, if the horizontal output of the sweep generator is functioning, additional information can be obtained using this output for the horizontal deflection system of the oscilloscope.

To assist in evaluating the tests made on the active devices, a chart of voltages and waveforms to be expected is shown in Figure 6-1.

When an out-of-limit condition is found to exist at the output terminal of a transistor, then the inputs to the device should be checked. If the required inputs are present, then the components associated with the output circuit should be examined sequentially until the point of signal interruption is discovered. This procedure should isolate the difficulty to a specific component.

In evaluating the RF assemblies, the D.C. inputs to these assemblies should be checked first. This procedure may isolate the difficulty to D.C. or low frequency inputs to these assemblies. If it becomes necessary to check the RF outputs, the coaxial cable should be disconnected, and a 50 ohm test cable employed to route the output to an external detector. The detected output may then be presented on the oscilloscope. If the RF output is interrupted ahead of the monitor assembly, the internal RF leveling system will be disabled, and the display on the oscilloscope will present the unleveled RF output.

If due to urgency it becomes expedient to undertake the repair of a RF assembly in the field, every effort should be made to dress and position the component replacement exactly as the original. This procedure should be followed by recalibration of the instrument.

## 6-4. Trouble-shooting Guide.

Figure 6-2 presents a listing of symptoms which have been experienced, probable cause, and remedial action to be taken.

s = start of sweep  e = end of sweep

| | DISPLAY | | | BLANKING | | |
|---|---|---|---|---|---|---|
| ITEM | COLL | BASE | EMIT | COLL | BASE | EMIT |
| Q-1 | 68.4 | 31.0 | 30.4 | | | |
| Q-2 | 31.5 | 62.0 | 31.0 | | | |
| Q-3 | 68.4 | 31.5 | 31.0 | | | |
| Q-4 | 31.5 | 7.6 | 7.0 | | | |
| Q-5 | -61.9 | -31.0 | -30.4 | | | |
| Q-6 | -31.7 | -63.4 | -63.9 | | | |
| Q-7 | -68.7 | -31.7 | -31.1 | | | |
| Q-8 | -31.7 | - 8.4 | - 7.8 | | | |
| Q-9 | 261. | 198. | 198. | | | |
| Q-10 | 264. | 199. | 198. | | | |
| Q-11 | 199. | 83. | 83. | | | |
| Q-101 | 18.1 | - 5.6 | - 6.0 | -20.0 | -15.3 | -14.0 |
| Q-102 | - 5.7 | - 5.4 | - 6.1 | 29.3 | -16.3 | -15.7 |
| Q-103s | 29. | - 1.8 | .67 | 29. | 1.6 | .58 |
| Q-103e | | - 1.6 | .58 | | | |
| Q-104s | .7 | 2.3 | .00 | .7 | 2.1 | .00 |
| Q-104e | 19.5 | 2.1 | | | | |
| Q-105s | 29. | .8 | .2 | 29. | .8 | .2 |

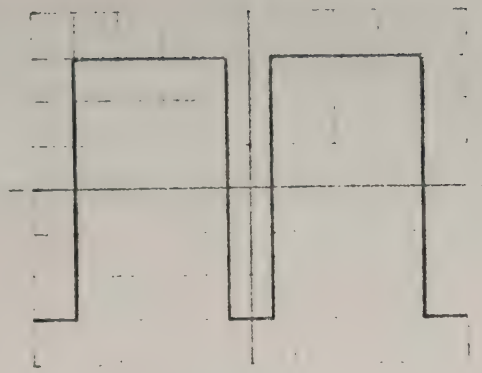
Figure 6-1. Typical Terminal Voltages

| | DISPLAY | | | BLANKING | | |
|---|---|---|---|---|---|---|
| ITEM | COLL | BASE | EMIT | COLL | BASE | EMIT |
| Q-105e | | 19.5 | 18.9 | | | |
| Q-106s | 3.3 | .0 | - .59 | 43.7 | .0 | - .58 |
| Q-106e | 43.7 | | - .58 | 3.3 | | - .59 |
| Q-107s | 1.3 | - 3.16 | - 3.77 | 124.8 | - 3.13 | - 3.5 |
| Q-107e | 124.8 | - 3.13 | - 3.5 | 1.3 | - 3.16 | - 3.77 |
| Q-109 | | | | | | |
| Q-201 | 68. | 22.1 | 21.5 | 67.6 | .0 | .0 |
| Q-202 | 22.1 | -16.7 | -16.1 | .0 | -17. | -13.3 |
| Q-203 | 22.1 | -26.9 | -16.1 | .0 | -16.6 | -13.3 |
| Q-204 | 29.6 | - 5.7 | - .9 | 29.6 | 29.3 | 28.9 |
| Q-206 | -16.7 | - .88 | - .29 | -17. | .0 | - .28 |
| Q-207 | -16.1 | - .92 | - .29 | -13.3 | - .92 | - .28 |
| Q-301 - Q-304 | - 1.35 | - .24 | - .06 | | | |
| Q-305 | - .9 | - .6 | - .5 | | | |
| Q-306 | - .9 | - .22 | .00 | | | |
| Q-307 | -20.1 | - .59 | .00 | | | |
| Q-400's | Video amplifier assembly. Do not check. | | | | | |
| Q-500's | Oscillator assemblies. Do not check. | | | | | |

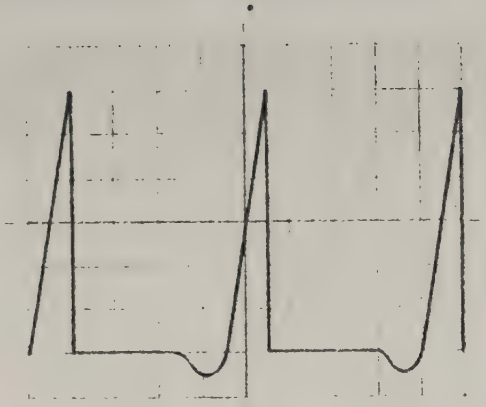
Figure 6-1. Typical Terminal Voltages

| | DISPLAY | | | BLANKING | | |
|---|---|---|---|---|---|---|
| ITEM | COLL | BASE | EMIT | COLL | BASE | EMIT |
| Q-105e | | 19.5 | 18.9 | | | |
| Q-106s | 3.3 | .0 | - .59 | 43.7 | .0 | - .58 |
| Q-106e | 43.7 | | - .58 | 3.3 | | - .59 |
| Q-107s | 1.3 | - 3.16 | - 3.77 | 124.8 | - 3.13 | - 3.5 |
| Q-107e | 124.8 | - 3.13 | - 3.5 | 1.3 | - 3.16 | - 3.77 |
| Q-109 | | | | | | |
| Q-201 | 68. | 22.1 | 21.5 | 67.6 | .0 | .0 |
| Q-202 | 22.1 | -16.7 | -16.1 | .0 | -17. | -13.3 |
| Q-203 | 22.1 | -26.9 | -16.1 | .0 | -16.6 | -13.3 |
| Q-204 | 29.6 | - 5.7 | - .9 | 29.6 | 29.3 | 28.9 |
| Q-206 | -16.7 | - .88 | - .29 | -17. | .0 | - .28 |
| Q-207 | -16.1 | - .92 | - .29 | -13.3 | - .92 | - .28 |
| Q-301 - Q-304 | - 1.35 | - .24 | - .06 | | | |
| Q-305 | - .9 | - .6 | - .5 | | | |
| Q-306 | - .9 | - .22 | .00 | | | |
| Q-307 | -20.1 | - .59 | .00 | | | |
| Q-400's | Video amplifier assembly. Do not check. | | | | | |
| Q-500's | Oscillator assemblies. Do not check. | | | | | |

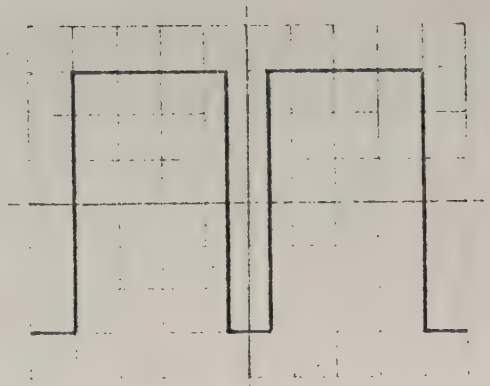
Figure 6-1. Typical Terminal Voltages



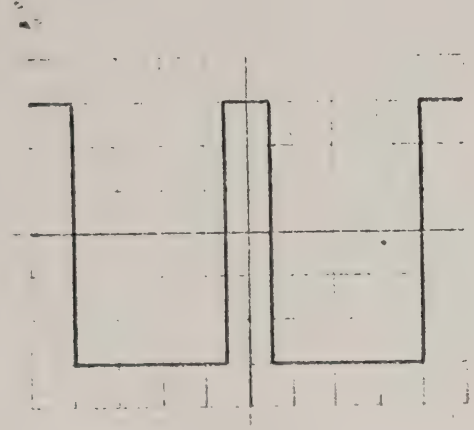
Q-101 Collector



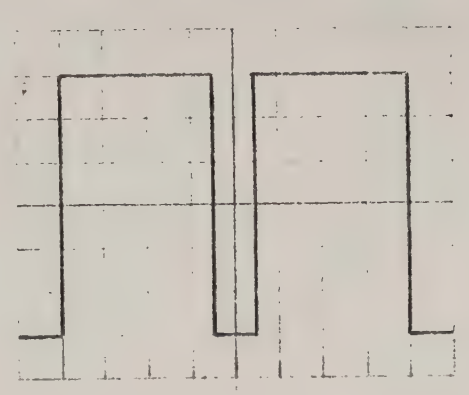
Q-101 Base



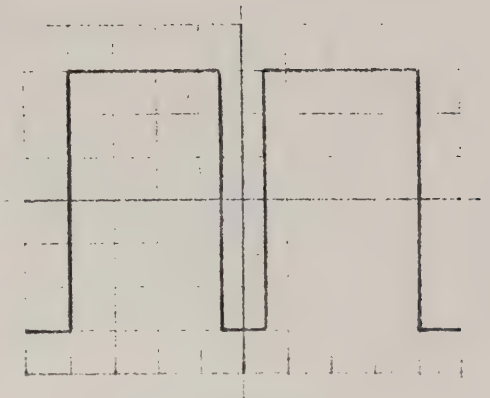
Q-101 Emitter



Q-102 Collector

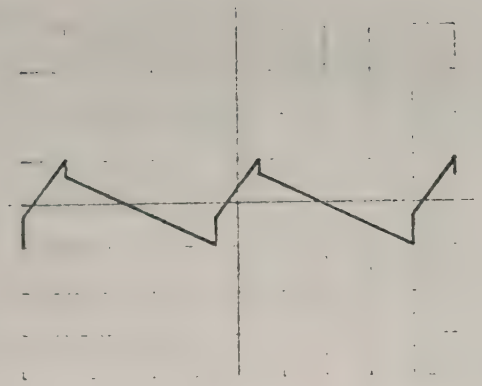


Q-102 Base

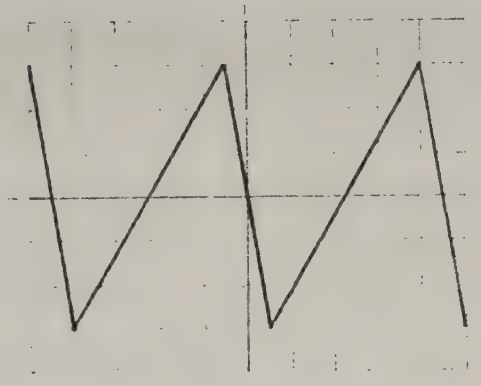


Q-102 Emitter

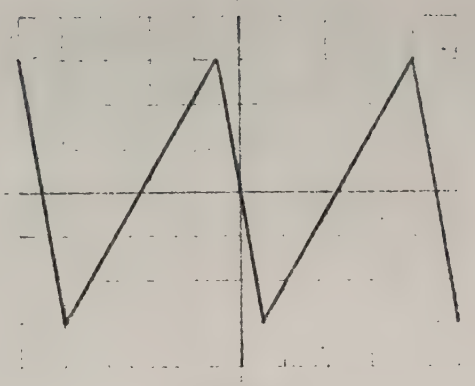
Figure 6-1. Waveforms



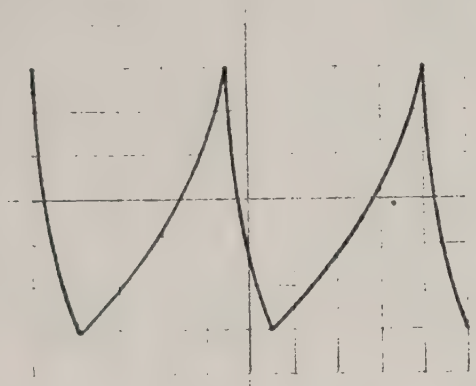
Q-103 Base



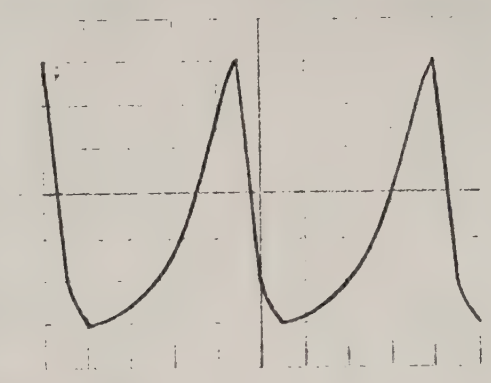
Q-104 Collector



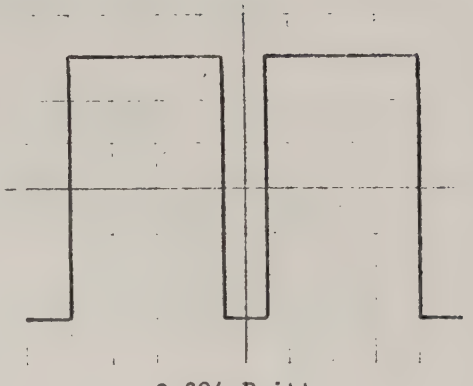
Q-105 Emitter



Q-106 Collector



Q-107 Collector



Q-204 Emitter

Figure 6-1. Waveforms

| SYMPTOM | PROBABLE CAUSE | REMEDIAL ACTION |
|---|---|---|
| No horizontal output | Rate circuit. | Check waveforms of rate circuit. |
| No birdie markers | Birdie marker preamplifier.<br>Birdie marker amplifier.<br>L-301 shorted. | Check birdie amplifier size controls.<br>Check birdie marker amplifier transistors.<br>Check resistance of L-301. |
| No external marker | External marker mixer.<br>Birdie marker amplifier. | Check CR-602, mixer diode.<br>Check Q-306. |
| RF flatness out-of-limit | Monitor detector.<br>Level control circuit. | Check CR-601.<br>Check transistors of level control circuit. |
| Power supply voltage out | Rectifiers open.<br>Regulating circuit. | Check forward resistance of rectifiers.<br>Check transistors and diodes. |
| Power supply ripple high | Filter capacitors open.<br><br>Regulating circuit.<br>Open rectifier diode. | Check charging characteristic with voltmeter.<br>Check transistors and diodes.<br>Check forward resistance of diodes. |
| Power supply voltages will not adjust properly. | Rectifier diode open.<br>Regulating transistors.<br><br>Reference element out. | Check forward resistance of diodes.<br>Check voltages at terminals of transistors.<br>Check Zener diodes and gas filled tube. |
| Insufficient sweep width | Sweep drive circuit. | Check waveforms at varactor drive input to VFO. |

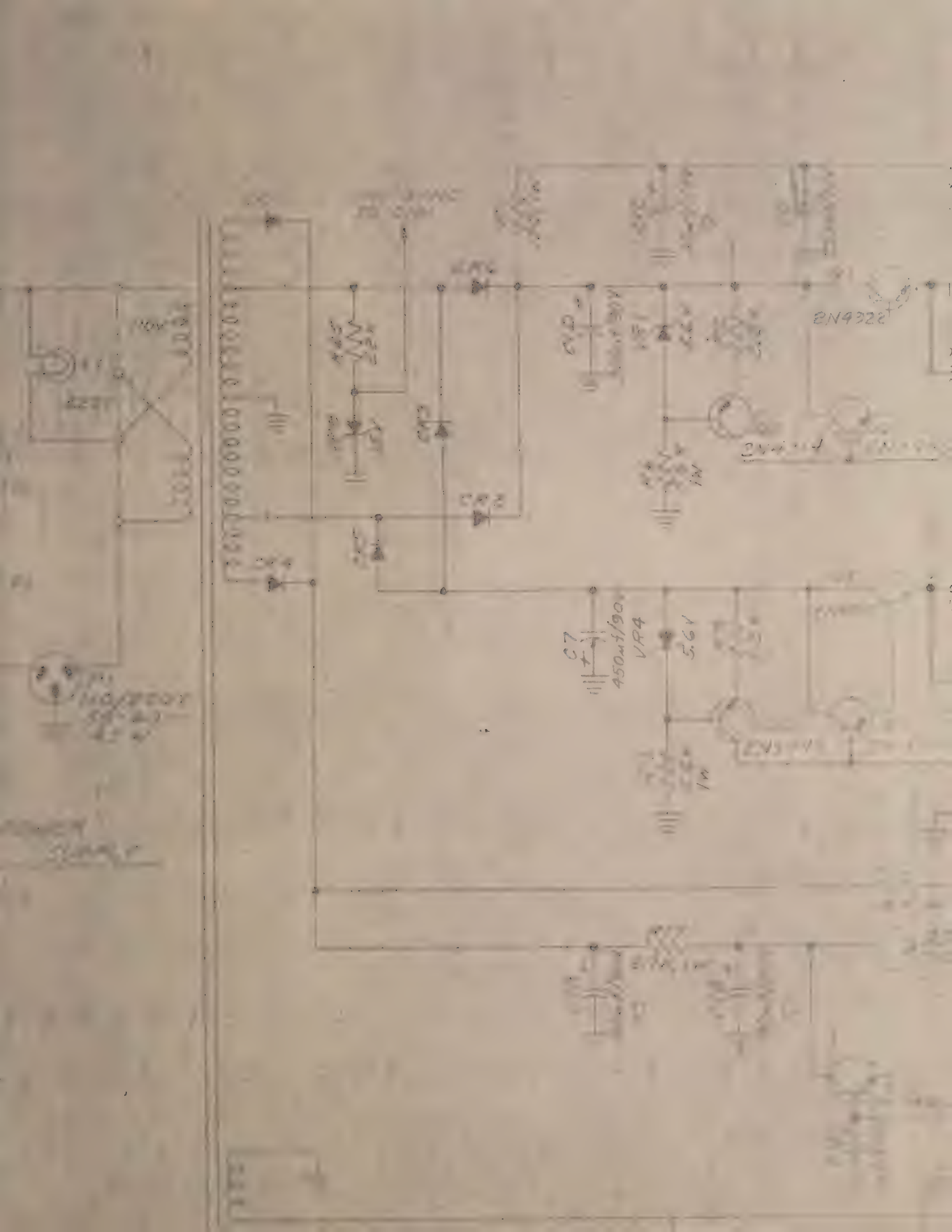
Figure 6-2. Trouble-shooting Guide

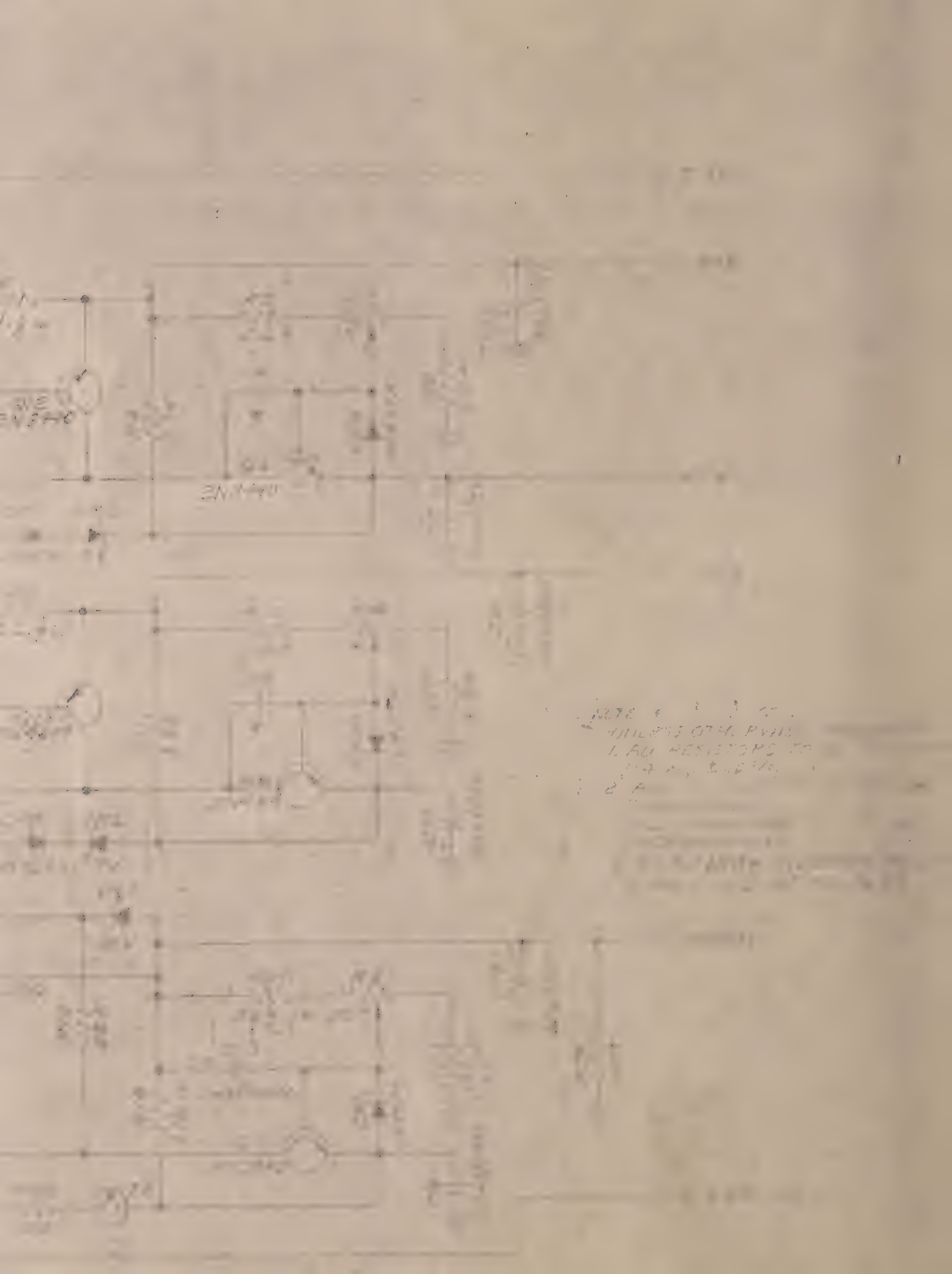
| SYMPTOM | PROBABLE CAUSE | REMEDIAL ACTION |
|---|---|---|
| Power switch ON. Pilot light not illuminated. | Power input fuse | Replace F-1 (1 A) |
| Fuse continues to blow | Transformer shorted.<br>Rectifiers shorted.<br>Power supply transistors.<br>Shorted filter capacitor.<br>Short across power supply. | Isolate and check transformer.<br>Check resistance of rectifiers.<br>Check resistance of transistors.<br>Check resistance of capacitors.<br>Check power supply output resistance to ground. |
| No RF output on HIGH or LOW bands | Power supply to RF circuits<br>Level control circuit.<br>RF cables.<br>Band switch.<br>Attenuator.<br>RF transistor failure. | Check D.C. inputs to RF assemblies.<br>Check level control circuit.<br>Trace RF signal.<br>Trace RF signal.<br>Trace RF signal.<br>Check RF transistors. |
| RF output on HIGH band & no RF output on LOW band. | Fixed frequency oscillator<br>Video amplifier.<br>Band switch. | Check fixed frequency oscillator.<br>Check video amplifier.<br>Trace signal through band switch. |
| RF output low on HIGH band. | RF maximum set control<br>+30V, -30V supply.<br>Leveler input to VFO.<br>VFO output low. | Check setting of R-210.<br>Check these voltages at the level control.<br>Check input to VFO.<br>Check VFO output in CW mode. |
| RF output low on LOW band. | Video amplifier. | Check inputs and output of video amplifier. |

Figure 6-2. Trouble-shooting Guide

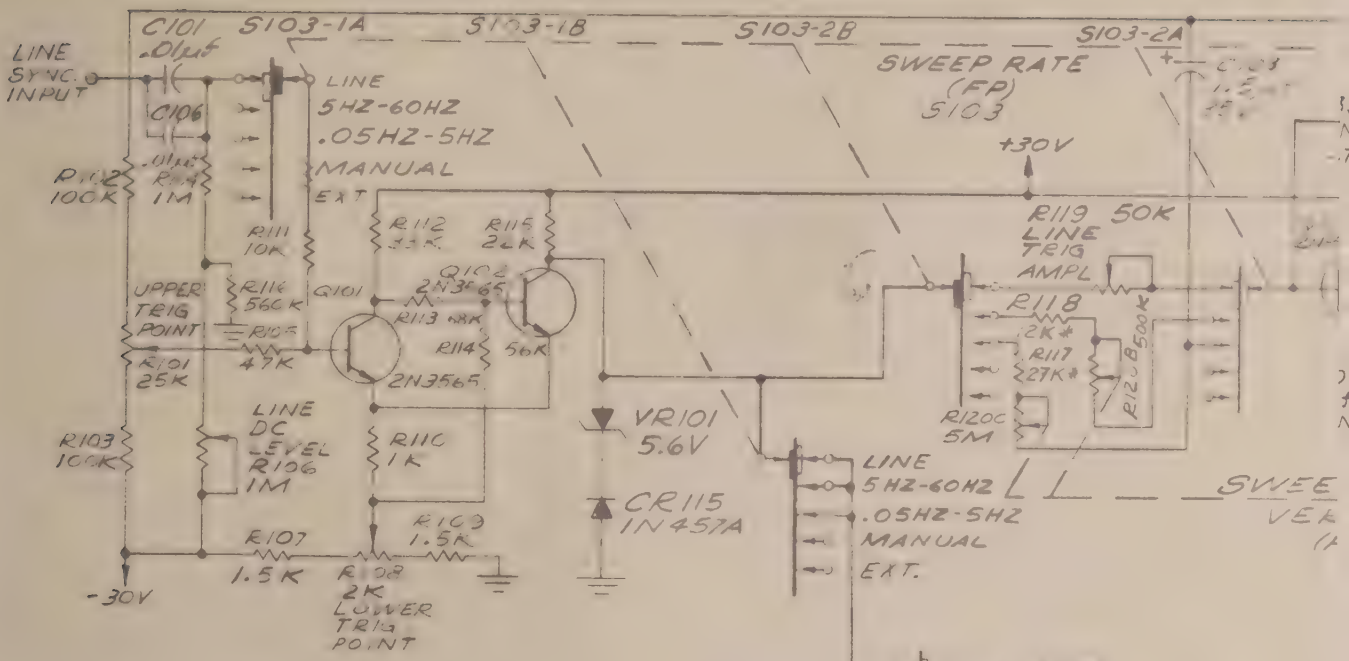
| SYMPTOM | PROBABLE CAUSE | REMEDIAL ACTION |
|---|---|---|
| No blanking. | Blanking circuit. | Check Q-109, Q-204, Q-203 |
| RF output present, but no display of detected RF. | External detector reversed. | Orient external detector properly. |
| "Grass" appears on trace. | Marker size set too high. | Reduce amplitude of marker. |
| Baseline of blanked trace is "tilted". | A.C. coupling to scope. | Use D.C. coupling to scope. |
| | | |

Figure 6-2. Trouble-shooting Guide

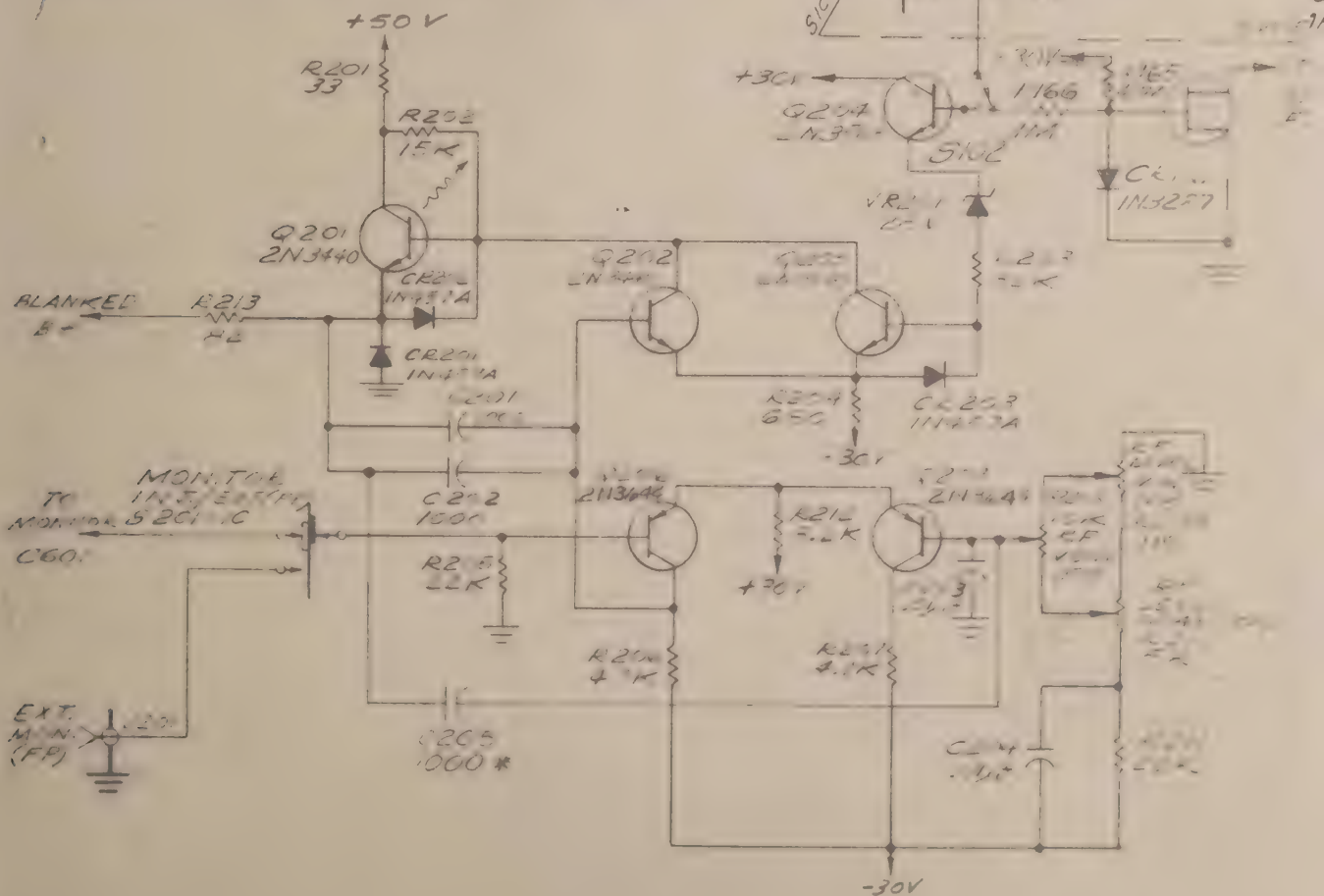

C7
450uf/90v
VR4
1M



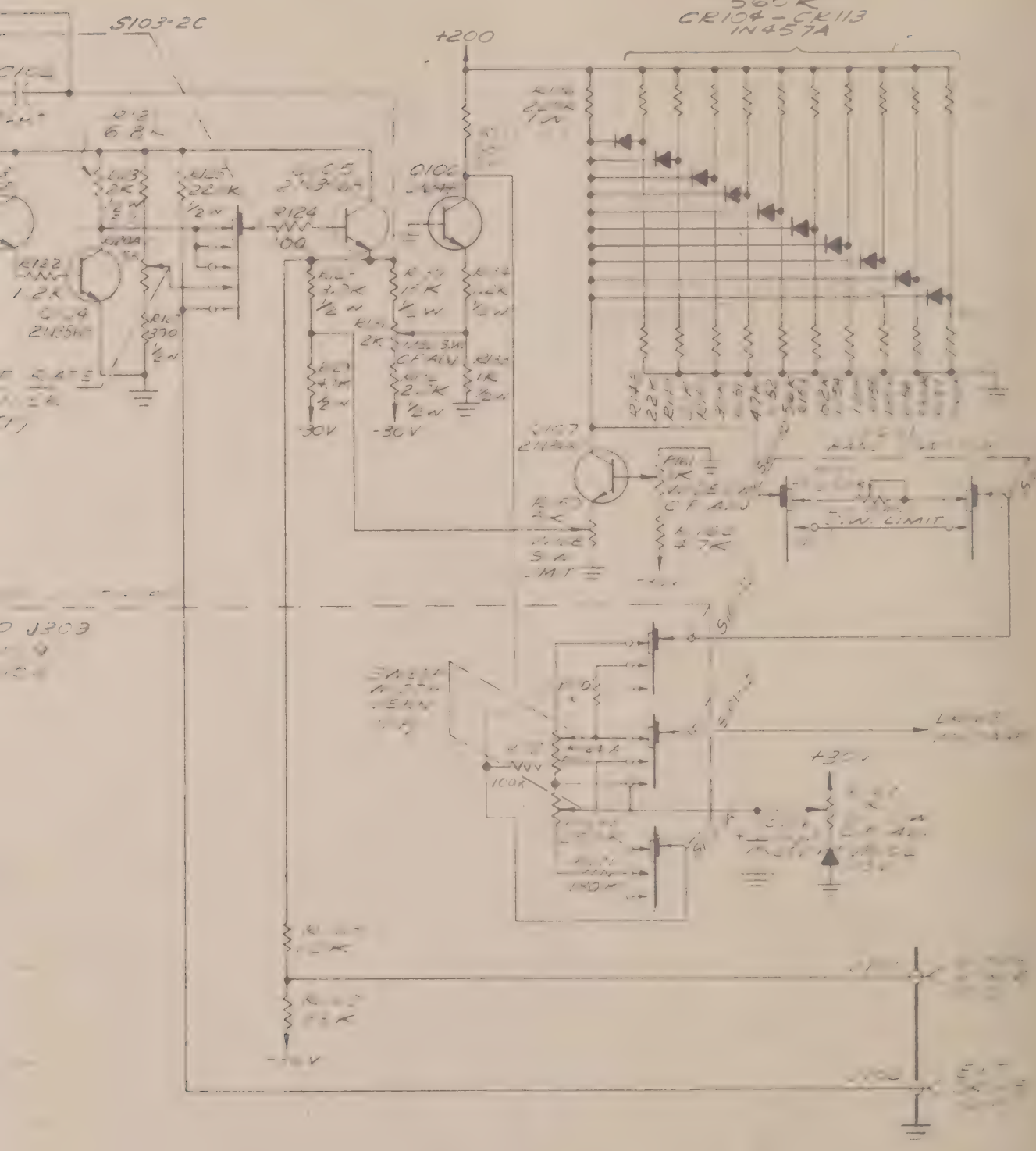
# RATE CIRCUIT



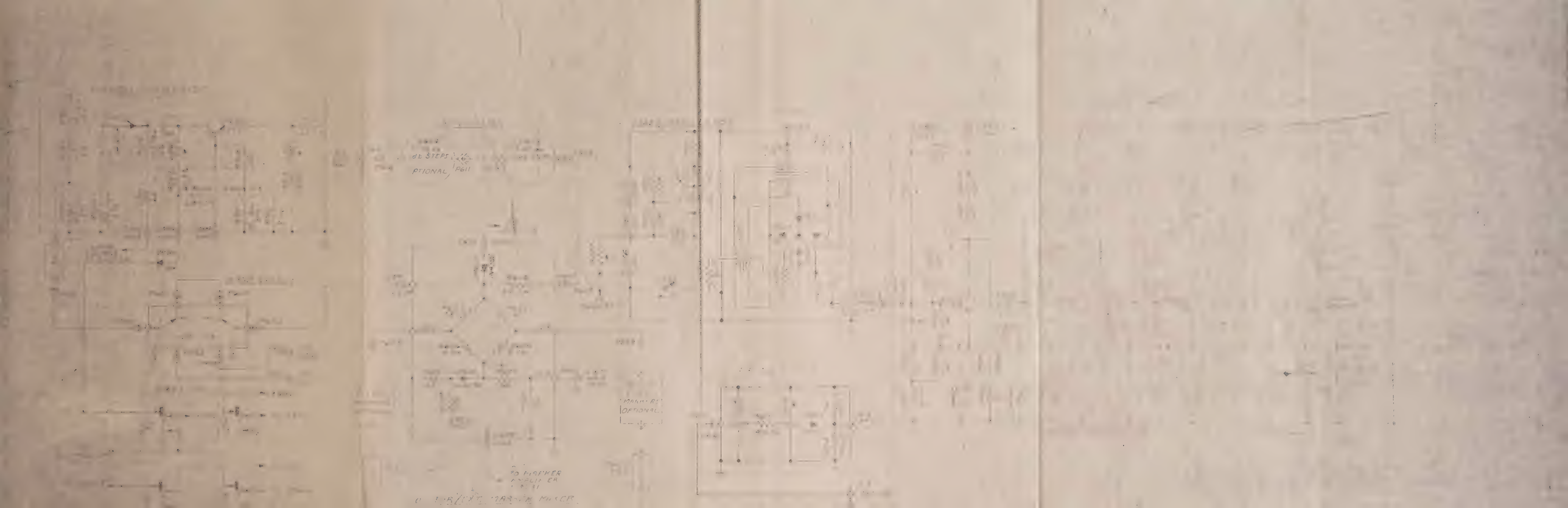

# BLANKING LEVELER CIRUIT

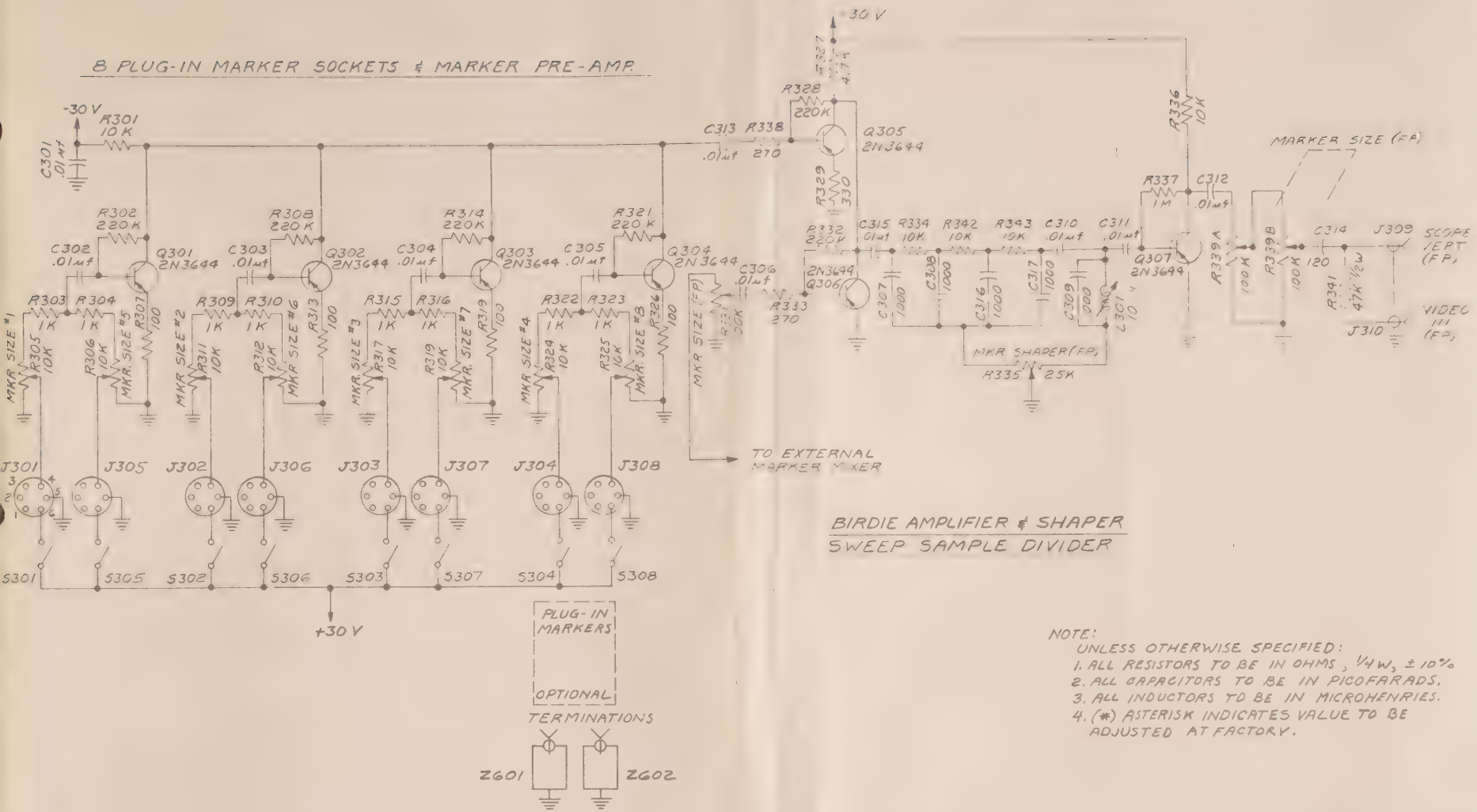


# LINEARITY




ALL RESISTORS TO BE IN OHMS, 1/4 W, ±10%
ALL CAPACITORS TO BE IN PICOFARADS
ALL INDUCTORS TO BE IN MICROHENRIES UNLESS OTHERWISE SPECIFIED
* - VALUE IS ADJUSTED AT FACTORY



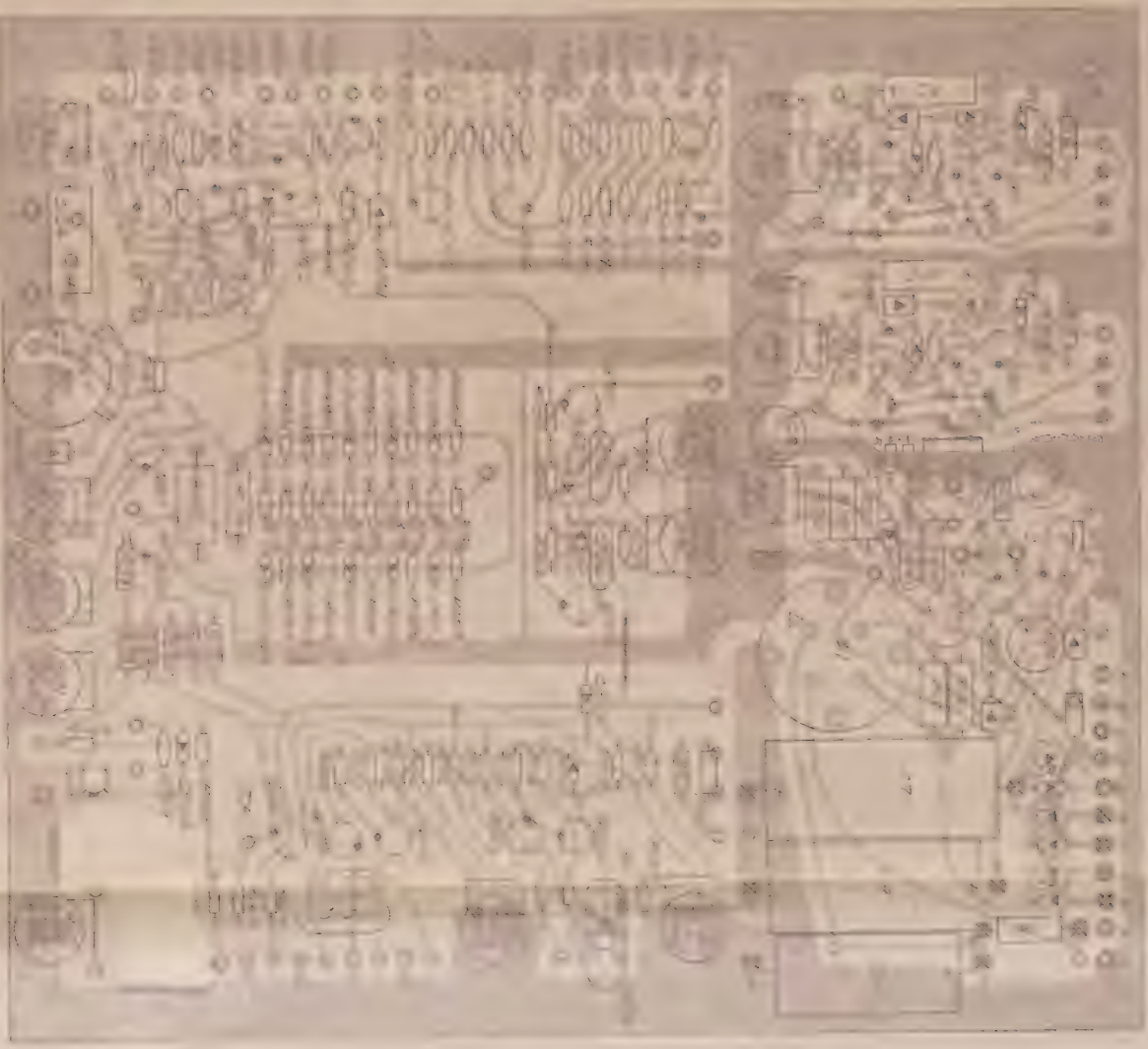


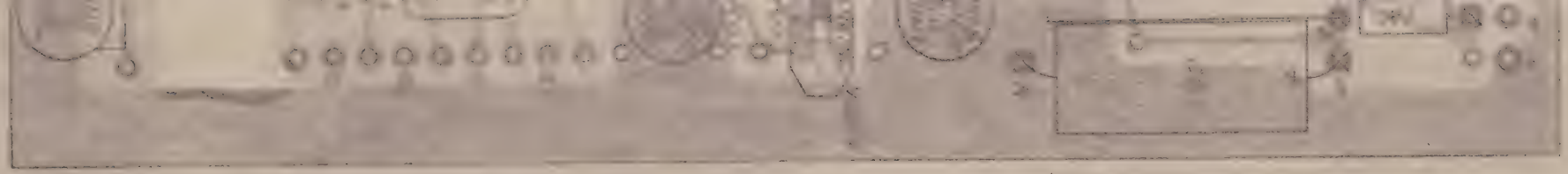

NOTE:
UNLESS OTHERWISE SPECIFIED:
1. ALL RESISTORS TO BE IN OHMS, 1/4 W, ± 10%
2. ALL CAPACITORS TO BE IN PICOFARADS.
3. ALL INDUCTORS TO BE IN MICROHENRIES.
4. (*) ASTERISK INDICATES VALUE TO BE ADJUSTED AT FACTORY.

EL6625-1559-14-TM-29

FINISH:

SPECIFICATIONS
DECIMAL DIMENSIONS TO BE ±
FRACTIONAL DIMENSIONS TO BE
DRILL, PUNCH, AND COMMERCI





The following factory options can be purchased and may be included as additional equipment for extended usage and performance parameters of the sweep generators.

RF Birdie Market Kit . . . . . Figure 5-6a

External Amplitude Modulation Kit . . . . . Figure 5-6b

Pen Lift Kit . . . . . Figure 5-6c

1 kHz Amplitude Modulation Kit . . . . . Figure 5-6d

Triggered Sweep Kit . . . . . Figure 5-6e

Figure 5-6. Option Schematics

## VENDOR IDENTIFICATION CODE

| NO. | VENDOR NAME | VENDOR ADDRESS | |
|---|---|---|---|
| 1 | Synchro Capacitor Corp. | Hicksville, Ohio | 43526 |
| 2 | Radio Materials Co. | Chicago, Ill. | 60646 |
| 3 | P. R. Mallory and Co., Inc. | Indianapolis, Ind. | 46206 |
| 4 | Sprague Electric Co. | North Adams, Mass. | 01247 |
| 5 | Standard Condenser Corp. | Chicago, Ill. | 60613 |
| 6 | Cornell-Dublier Electronics Div. | Newark, N. J. | 07101 |
| 7 | Kemet Div., Union Carbide Corp. | Greenville, S. C. | 29606 |
| 8 | Arco Electronics, Inc. | Great Neck, N. Y. | 11021 |
| 9 | Centralab Div., Globe-Union, Inc. | Milwaukee, Wis. | 53201 |
| 10 | Allen Bradley Co. | Milwaukee, Wis. | 53204 |
| 11 | JFD Electronics Div., Sarge Corp. | Brooklyn, N. Y. | 11219 |
| 12 | Quality Components, Inc. | St. Marys, Pa. | 15857 |
| 13 | Sarkes Tarzian, Inc. | Bloomington, Ind. | 47401 |
| 14 | General Electric Co., Components | Oak Brook, Ill. | 60521 |
| 15 | Hughes Aircraft Corp. | Newport Beach, Cal. | 92663 |
| 16 | Sylvania Electric Products, Inc. | Woburn, Mass. | 01801 |
| 17 | International Telephone and Telegraph | San Fernando, Cal. | 91342 |
| 18 | CTS Corp. | Elkhart, Ind. | 46514 |
| 19 | Motorola Semiconductor Products, Inc. | Phoenix, Ariz. | 85010 |
| 20 | Radio Corp. of America | Harrison, N. J. | 07029 |
| 21 | Fairchild Semiconductor Div. | Mountain View, Cal. | 94040 |
| 22 | TRW Semiconductors, Inc. | Los Angeles, Cal. | 90024 |
| 23 | Continental-Wirt Electronics Corp. | Philadelphia, Pa. | 19144 |
| 24 | Stackpole Carbon Co. | St. Marys, Pa. | 15857 |
| 25 | Texscan Corp. | Indianapolis, Ind. | 46219 |
| 26 | Texas Instruments, Inc. | Dallas, Tex. | 75222 |
| 27 | Littlefuse, Inc. | Des Plaines, Ill. | 60016 |
| 28 | Drake Manufacturing Co. | Harwood Heights, Ill. | 60656 |
| 29 | Signalite, Inc. | Neptune, N. J. | 07753 |
| 30 | Startronics, Inc. | Georgetown, Mass. | 01830 |
| 31 | Cinch Manufacturing Co. | Elk Grove Vil'ge, Ill. | 60007 |
| 32 | Central Coil Co., Inc. | Martinsville, Ind. | 46151 |
| 33 | Airco Speer Electronics (Jeffers) | Bradford, Pa. | 16701 |
| 34 | Varian Associates | Beverley, Mass. | 01915 |
| 35 | American Magnetics | Carterville, Ill. | 62918 |
| 36 | Cord Specialty | Franklin Park, Ill. | 60131 |

## CAPACITORS

| CIRCUIT REF. NO. | TEXSCAN PART NO. | DESCRIPTION | VENDOR NO. | VENDOR PART NO. |
|---|---|---|---|---|
| C1A,C1B, C1C,C1D | 012-221 | 100uF/300V; 80uF/250V; 30uF/150V; 300uF/75V | 1 | MEP 386Y 10816921 |
| C2 | 012-223 | 250uF/75V | 1 | EMW 2052-250-75 |
| C4 | 012-052 | 200pF/1000V, Disc | 2 | Type C N-1500 |
| C5 | 012-082 | 50uF/50V | 3 | PET 1980 |
| C6 | 012-015 | 100uF/12V | 4 | 30D107G012DC4 |
| C7 | 012-222 | 450uF/90V | 1 | EMC 2868-450-90 |
| C8 | 012-082 | 50uF/50V | 3 | PET 1980 |
| C9 | 012-052 | 200pF/1000V, Disc | 2 | Type C N-1500 |
| C10 | 012-015 | 100uF/12V | 4 | 30D107G012DC4 |
| C13 | 012-023 | 0.1uF/200V | 5 | MBA 200 |
| C15 | 012-023 | 0.1uF/200V | 5 | MBA 200 |
| C16 | 012-024 | 0.22uF/200V | 5 | MBA 200 |
| C101 | 012-066 | 0.01uF/100V | 4 | 225P10931 |
| C102 | 012-020 | 0.22uF/100V | 6 | DMF 1P22 |
| C103 | 012-155 | 1.5uF/35V | 7 | KIR5C35K |
| C104 | 012-016 | 100uF/25V | 4 | 30D107G025DD2 |
| C106 | 012-066 | 0.01uF/100V | 4 | 225P10931 |
| C201 | 012-009 | 1000pF/500V | 2 | SM.001 |
| C202 | 012-009 | 1000pF/500V | 2 | SM.001 |
| C203 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C204 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C205 | 012-009 | 1000pF/500V | 2 | SM.001 |
| C301 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C302 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C303 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C304 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C305 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C306 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C307 | 012-009 | 1000pF/500V | 2 | SM.001 |
| C308 | 012-009 | 1000pF/500V | 2 | SM.001 |
| C309 | 012-009 | 1000pF/500V | 2 | SM.001 |
| C310 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C311 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C312 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C313 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C314 | 012-013 | 120pF/1000V | 2 | C-120-N-1500 |
| C315 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C316 | 012-009 | 1000pF/500V | 2 | SM.001 |

CAPACITORS (Cont:)

| CIRCUIT REF. NO. | TEXSCAN PART NO. | DESCRIPTION | VENDOR NO. | VENDOR PART NO. |
|---|---|---|---|---|
| C401 | 012-083 | 12pF/500V | 2 | 12NPO |
| C402 | 015-009 | .8-60pF, Variable | 8 | 404 |
| C403 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C404 | 012-009 | 1000pF/500V | 2 | SM.001 |
| C405 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C406 | 012-092 | 5pF/1000V | 2 | Type C NPO |
| C407 | 012-009 | 1000pF/500V | 2 | SM.001 |
| C408 | 015-009 | .8-60pF, Variable | 8 | 404 |
| C409 | 012-011 | 10pF/1000V | 2 | TC NPO |
| C410 | 012-083 | 12pF/500V | 2 | 12NPO |
| C411 | 012-103 | 15pF/1000V | 2 | Type C NPO |
| C412 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C413 | 012-031 | 68pF/500V | 9 | DD 680 |
| C415 | 015-009 | .8-60pF, Variable | 8 | 404 |
| C416 | 012-114 | .02uF/100V | 2 | TA.02 |
| C417 | 012-143 | 220pF/1000V | 2 | Type B |
| C418 | 012-083 | 12pF/500V | 2 | 12NPO |
| C419 | 012-050 | 0.01uF/100V | 2 | TA.01 |
| C421 | 012-085 | .005uF/500V | 2 | SM.005 |
| C422 | 015-009 | .8-60pF, Variable | 8 | 404 |
| C423 | 012-114 | 0.02uF/100V | 2 | TA.02 |
| C424 | 012-009 | 1000pf/500V | 2 | SM.001 |
| C425 | 012-001 | 1000pF | 10 | FA5C GMV |
| C426 | 012-001 | 1000pF | 10 | FA5C GMV |
| C427 | 012-001 | 1000pF | 10 | FA5C GMV |
| C428 | 012-001 | 1000pF | 10 | FA5C GMV |
| C429 | 012-001 | 1000pF | 10 | FA5C GMV |
| C431 | 012-001 | 1000pF | 10 | FA5C GMV |
| C432 | 012-001 | 1000pF | 10 | FA5C GMV |
| C433 | 012-001 | 1000pF | 10 | FA5C GMV |
| C434 | 012-001 | 1000pF | 10 | FA5C GMV |
| C435 | 012-058 | 120pF | 10 | FA5C |
| C501 | 012-118 | 100pF, Chip | 11 | FCJ-81 |
| C502 | 012-001 | 1000pF | 10 | FA5C GMV |
| C503 | 012-001 | 1000pF | 10 | FA5C GMV |
| C504 | 012-037 | 1000pF | 10 | SS5A-102W |
| C551 | 012-001 | 1000pF | 10 | FA5C GMV |
| C552 | 012-001 | 1000pF | 10 | FA5C GMV |
| C553 | 015-004 | .8-12pF, Variable | 11 | VC-22GY |
| C554 | 012-056 | .75pF | 12 | Axial lead ceramic |
| C555 | 012-005 | 0.01uF/500V | 2 | Z5U.01 |
| C556 | 012-103 | 15pF/500V | 2 | Type C NPO |
| C557 | 012-001 | 1000pF | 10 | FA5C GMV |

CAPACITORS (Cont:)

| CIRCUIT REF. NO. | TEXSCAN PART NO. | DESCRIPTION | VENDOR NO. | VENDOR PART NO. |
|---|---|---|---|---|
| C601 | 012-002 | 1000pF | 10 | FW5V 102W |
| C603 | 012-009 | 1000pF/500V | 2 | SM.001 |
| C604 | 012-001 | 1000pF | 10 | FA5C GMV |
| CV501 | 064-006 | 4pF/200V, Variable Diode | 35 | VAT 22ET |

CRYSTAL RECTIFIERS

| | | | | |
|---|---|---|---|---|
| CR1 | 025-044 | PIV 880 .02W/SEC | 13 | E-8 |
| CR2 | 025-007 | PIV 400 | 14 | A13D2 |
| CR3 | 025-007 | PIV 400 | 14 | A13D2 |
| CR4 | 025-044 | PIV 800 1A | 13 | E-8 |
| CR5 | 025-007 | PIV 400 | 14 | A13D2 |
| CR6 | 025-007 | PIV 400 | 14 | A13D2 |
| CR7 | 025-034 | 1N457A | 16 | |
| CR8 | 025-034 | 1N457A | 16 | |
| CR9 | 025-034 | 1N457A | 16 | |
| CR10 | 025-034 | 1N457A | 16 | |
| CR11 | 025-034 | 1N457A | 16 | |
| CR104 | 025-034 | 1N457A | 16 | |
| CR105 | 025-034 | 1N457A | 16 | |
| CR106 | 025-034 | 1N457A | 16 | |
| CR107 | 025-034 | 1N457A | 16 | |
| CR108 | 025-034 | 1N457A | 16 | |
| CR109 | 025-034 | 1N457A | 16 | |
| CR110 | 025-034 | 1N457A | 16 | |
| CR111 | 025-034 | 1N457A | 16 | |
| CR112 | 025-034 | 1N457A | 16 | |
| CR113 | 025-034 | 1N457A | 16 | |
| CR115 | 025-034 | 1N457A | 16 | |
| CR116 | 025-061 | 1N3287 | 17 | |
| CR201 | 025-034 | 1N457A | 16 | |
| CR202 | 025-034 | 1N457A | 16 | |
| CR203 | 025-034 | 1N457A | 16 | |
| CR502 | 025-016 | PIV 20, UHF Use | 15 | HD5003 |
| CR551 | 025-027 | 1N82A | 16 | |
| CR552 | 025-027 | 1N82A | 16 | |
| CR553 | 025-027 | 1N82A | 16 | |
| CR554 | 025-027 | 1N82A | 16 | |
| CR601 | 025-016 | PIV 20, UHF Use | 15 | HD5003 |
| CR602 | 025-002 | 1N82AS | 16 | Glass package |

## FILTER

| CIRCUIT REF. NO. | TEXSCAN PART NO. | DESCRIPTION | VENDOR NO. | VENDOR PART NO. |
|---|---|---|---|---|
| FL-501 | B071-004 | Cut-off 1400 MHz | 25 | B071-004 |
| FL-551 | A204-214 | Cut-off 300 MHz | 25 | A204-214 |

## FUSES

| | | | | |
|---|---|---|---|---|
| F1 | 034-001 | Type 3AG 1A | 27 | 312-3AG-1A |

## PILOT LIGHTS

| | | | | |
|---|---|---|---|---|
| I1 | 011-001 | 125V/0.6mA Incan | 28 | 6063-634 |
| I2 | 011-003 | 82V/3mA Gas type | 29 | Z82R10 |

## JACKS

| | | | | |
|---|---|---|---|---|
| J101 | 020-016 | RF Connector | 30 | #5069 |
| J102 | 020-011 | UG625B/U | 30 | UG625B/U |
| J201 | 020-016 | RF Connector | 30 | #5069 |
| J301 | 054-003 | Socket, 6 Pin | 31 | 201-41-06-243 |
| J302 | 054-003 | Socket, 6 Pin | 31 | 201-41-06-243 |
| J303 | 054-003 | Socket, 6 Pin | 31 | 201-41-06-243 |
| J304 | 054-003 | Socket, 6 Pin | 31 | 201-41-06-243 |
| J305 | 054-003 | Socket, 6 Pin | 31 | 201-41-06-243 |
| J306 | 054-003 | Socket, 6 Pin | 31 | 201-41-06-243 |
| J307 | 054-003 | Socket, 6 Pin | 31 | 201-41-06-243 |
| J308 | 054-003 | Socket, 6 Pin | 31 | 201-41-06-243 |
| J309 | 020-016 | RF Connector | 30 | #5069 |
| J310 | 020-016 | RF Connector | 30 | #5069 |
| J401 | 020-030 | UG185/U | 30 | UG185/U |
| J402 | 020-011 | UG625B/U | 30 | UG625B/U |
| J501 | 020-044 | UG535/U | 30 | #535 |
| J551 | 020-030 | UG185/U | 30 | UG185/U |
| J601 | C200-030-02 | Switch Assembly | 25 | C200-030-02 |
| J602 | C200-030-02 | Switch Assembly | 25 | C200-030-02 |
| J603 | C200-030-02 | Switch Assembly | 25 | C200-030-02 |
| J604 | 020-011 | UG625B/U | 30 | UG625B/U |
| J605 | A204-250 | Cable Set | 25 | Internal Marker |
| J607 | 020-011 | UG625B/U | 30 | UG625B/U |
| J608 | B200-200-01 | 0 - 70 db | 25 | B200-200-01 |
| J609 | A204-250 | Cable Set | 25 | Internal Marker |
| J610 | A204-250 | Cable Set | 25 | External Marker |
| J612 | B200-200-00 | 0 - 10 db | 25 | B200-200-00 |

## INDUCTORS

| CIRCUIT REF. NO. | TEXSCAN PART NO. | DESCRIPTION | VENDOR NO. | VENDOR PART NO. |
|---|---|---|---|---|
| L301 | 035-008 | 10 mH | 32 | H0813-15 |
| L401 | A035-029 | Fixed Inductor | 25 | A035-029 |
| L402 | A035-029 | Fixed Inductor | 25 | A035-029 |
| L403 | A035-029 | Fixed Inductor | 25 | A035-029 |
| L404 | A035-029 | Fixed Inductor | 25 | A035-029 |
| L405 | 035-024 | 0.22 uH | 33 | #4416-5K |
| L406 | 035-024 | 0.22 uH | 33 | #4416-5K |
| L407 | 035-024 | 0.22 uH | 33 | #4416-5K |
| L501 | 035-004 | 0.68 uH | 33 | #4426-4K |
| L502 | A035-035-01 | Wire Wound | 25 | A035-035-01 |
| L503 | A035-035-02 | Wire Wound | 25 | A035-035-01 |
| L551 | 035-002 | 2.2 uH | 33 | #4436-4K |

## PLUGS

| | | | | |
|---|---|---|---|---|
| P1 | 019-004 | Power Cord | 36 | SV-18/3 U-gnd plug |
| P403 | A204-250 | Cable Set | 25 | Band Switch to video |
| P404 | A204-250 | Cable Set | 25 | Band Switch to video |
| P502 | A204-250 | Cable Set | 25 | VFO to Band Switch |
| P551 | A204-250 | Cable Set | 25 | FFO to Band Switch |
| P552 | A204-250 | Cable Set | 25 | FFO to Band Switch |
| P601 | A204-250 | Cable Set | 25 | Band Switch Jumper |
| P602 | A204-250 | Cable Set | 25 | Band Switch Jumper |
| P603 | A204-250 | Cable Set | 25 | Band Switch/Monitor |
| P604 | A204-250 | Cable Set | 25 | Band Switch/Monitor |
| P605 | A204-250 | Cable Set | 25 | Monitor/Markers |
| P607 | A204-250 | Cable Set | 25 | Monitor/Attenuator |
| P608 | A204-250 | Cable Set | 25 | Monitor/Attenuator |
| P609 | A204-250 | Cable Set | 25 | Monitor/Markers |
| P610 | A204-250 | Cable Set | 25 | Atten/Atten Jumper |
| P611 | A204-250 | Cable Set | 25 | Atten/Atten Jumper |

## TRANSISTORS

| | | | | |
|---|---|---|---|---|
| Q1 | 062-054 | 2N4922 | 19 | |
| Q2 | 062-048 | 40362 | 20 | 40362 |
| Q3 | 062-005 | 2N3053 | 20 | |
| Q4 | 062-005 | 2N3053 | 20 | |
| Q5 | 062-053 | 2N4919 | 19 | |
| Q6 | 062-005 | 2N3053 | 20 | |

TRANSISTORS (Cont:)

| CIRCUIT REF. NO. | TEXSCAN PART NO. | DESCRIPTION | VENDOR NO. | VENDOR PART NO. |
|---|---|---|---|---|
| Q7 | 062-048 | 40362 | 20 | 40362 |
| Q8 | 062-048 | 40362 | 20 | 40362 |
| Q9 | 062-055 | MJE 340 | 19 | MJE 340 |
| Q10 | 062-008 | 2N3440 | 20 | |
| Q11 | 062-008 | 2N3440 | 20 | |
| Q101 | 062-002 | 2N3565 | 21 | |
| Q102 | 062-002 | 2N3565 | 21 | |
| Q103 | 062-002 | 2N3565 | 21 | |
| Q104 | 062-015 | 2N3568 | 21 | |
| Q105 | 062-015 | 2N3568 | 21 | |
| Q106 | 062-008 | 2N3440 | 20 | |
| Q107 | 062-008 | 2N3440 | 20 | |
| Q109 | 062-012 | 2N4221 | 19 | Field Effect Xstr |
| Q201 | 062-008 | 2N3440 | 20 | |
| Q202 | 062-008 | 2N3440 | 20 | |
| Q203 | 062-008 | 2N3440 | 20 | |
| Q204 | 062-015 | 2N3568 | 21 | |
| Q206 | 062-024 | 2N3644 | 21 | |
| Q207 | 062-024 | 2N3644 | 21 | |
| Q301 | 062-024 | 2N3644 | 21 | |
| Q302 | 062-024 | 2N3644 | 21 | |
| Q303 | 062-024 | 2N3644 | 21 | |
| Q304 | 062-024 | 2N3644 | 21 | |
| Q305 | 062-024 | 2N3644 | 21 | |
| Q306 | 062-024 | 2N3644 | 21 | |
| Q307 | 062-024 | 2N3644 | 21 | |
| Q401 | 062-035 | 2N5109 | 20 | |
| Q402 | 062-035 | 2N5109 | 20 | |
| Q403 | 062-035 | 2N5109 | 20 | |
| Q404 | 062-031 | 2N4429 | 22 | |
| Q501 | 062-051 | FT-37 | 21 | S-29043 |
| Q551 | 062-013 | SE-3002 | 21 | SE-3002 |
| Q552 | 062-013 | SE-3002 | 21 | SE-3002 |

RESISTORS

| | | | |
|---|---|---|---|
| R1 | 046-372 | 120 ohm, 1W, 10% | 10 |
| R2 | 046-124 | 2.2K ohm, ½W, 10% | 10 |
| R3 | 046-337 | 18 ohm, 1W, 10% | 10 |
| R4 | 046-131 | 3.3K ohm, ½W, 10% | 10 |
| R5 | 046-142 | 5.6K ohm, ½W, 10% | 10 |
| R6 | 046-142 | 5.6K ohm, ½W, 10% | 10 |

RESISTORS (Cont:)

| CIRCUIT REF. NO. | TEXSCAN PART NO. | DESCRIPTION | VENDOR NO. | VENDOR PART NO. |
|---|---|---|---|---|
| R7 | 048-030 | 1K ohm, Variable | 18 | UPE200RE |
| R8 | 046-124 | 2.2K ohm, ½W, 10% | 10 | |
| R9 | 046-124 | 2.2K ohm, ½W, 10% | 10 | |
| R10 | 046-337 | 18 ohm, 1W, 10% | 10 | |
| R11 | 046-131 | 3.3K ohm, ½W, 10% | 10 | |
| R12 | 046-142 | 5.6K ohm, ½W, 10% | 10 | |
| R13 | 046-142 | 5.6K ohm, ½W, 10% | 10 | |
| R14 | 048-030 | 1K ohm, Variable | 18 | UPE200RE |
| R15 | 046-124 | 2.2K ohm, ½W, 10% | 10 | |
| R16 | 046-463 | 18K ohm, 1W, 10% | 10 | |
| R17 | 046-028 | 2.7K ohm, 1W, 10% | 10 | |
| R18 | 046-166 | 22K ohm, ½W, 10% | 10 | |
| R19 | 046-480 | 47K ohm, 1W, 10% | 10 | |
| R20 | 046-483 | 56K ohm, 1W, 5% | 10 | |
| R21 | 048-026 | 25K ohm, Variable | 18 | UPE200RE |
| R22 | 046-068 | 100 ohm, ½W, 10% | 10 | |
| R23 | 046-476 | 39K ohm, 1W, 5% | 10 | |
| R24 | 046-205 | 180K ohm, ½W, 10% | 10 | |
| R25 | 046-166 | 22K ohm, ½W, 10% | 10 | |
| R101 | 048-026 | 25K ohm, Variable | 18 | UPE200RE |
| R102 | 045-794 | 100K ohm, ¼W, 10% | 10 | |
| R103 | 045-794 | 100K ohm, ¼W, 10% | 10 | |
| R104 | 045-836 | 1M ohm, ¼W, 10% | 10 | |
| R105 | 045-780 | 47K ohm, ¼W, 10% | 10 | |
| R106 | 048-032 | 1M ohm, Variable | 18 | UPE200RE |
| R107 | 045-717 | 1.5K ohm, ¼W, 10% | 10 | |
| R108 | 048-023 | 2K ohm, Variable | 18 | UPE200RE |
| R109 | 045-717 | 1.5K ohm, ¼W, 10% | 10 | |
| R110 | 045-710 | 1K ohm, ¼W, 10% | 10 | |
| R111 | 045-752 | 10K ohm, ¼W, 10% | 10 | |
| R112 | 045-773 | 33K ohm, ¼W, 10% | 10 | |
| R113 | 045-787 | 68K ohm, ¼W, 10% | 10 | |
| R114 | 045-784 | 56K ohm, ¼W, 10% | 10 | |
| R115 | 045-766 | 22K ohm, ¼W, 10% | 10 | |
| R116 | 045-826 | 560K ohm, ¼W, 10% | 10 | |
| R117 | 045-770 | 27K ohm, ¼W, 10% | 10 | |
| R118 | 045-756 | 12K ohm, ¼W, 10% | 10 | |
| R119 | 048-054 | 50K ohm, Variable | 18 | UPE200RE |
| R120 | 048-094 | 500K/5K/5M ohm w/S103 | 18 | C-21-25211-3-3 |
| R121 | 045-749 | 8.2K ohm, ¼W, 10% | 10 | |
| R122 | 045-714 | 1.2K ohm, ¼W, 10% | 10 | |
| R123 | 046-122 | 2K ohm, ½W, 5% | 10 | |
| R124 | 045-668 | 100 ohm, ¼W, 10% | 10 | |

RESISTORS (Cont:)

| CIRCUIT REF. NO. | TEXSCAN PART NO. | DESCRIPTION | VENDOR NO. | VENDOR PART NO. |
|---|---|---|---|---|
| R125 | 046-208 | 220K ohm, ½W, 10% | 10 | |
| R127 | 046-093 | 390 ohm, ½W, 10% | 10 | |
| R128 | 046-135 | 3.9K ohm, ½W, 10% | 10 | |
| R129 | 046-138 | 4.7K ohm, ½W, 10% | 10 | |
| R130 | 046-159 | 15K ohm, ½W, 10% | 10 | |
| R131 | 048-023 | 2K ohm, Variable | 18 | UPE200RE |
| R132 | 046-128 | 2.7K ohm, ½W, 10% | 10 | |
| R133 | 046-110 | 1K ohm, ½W, 10% | 10 | |
| R134 | 046-114 | 1.2K ohm, ½W, 10% | 10 | |
| R135 | 046-787 | 68K ohm, 2W, 10% | 10 | |
| R136 | 046-508 | 220K ohm, 1W, 5% | 10 | |
| R137 | 045-826 | 560K ohm, ¼W, 10% | 10 | |
| R138 | 045-826 | 560K ohm, ¼W, 10% | 10 | |
| R139 | 045-826 | 560K ohm, ¼W, 10% | 10 | |
| R140 | 045-826 | 560K ohm, ¼W, 10% | 10 | |
| R141 | 045-826 | 560K ohm, ¼W, 10% | 10 | |
| R142 | 045-826 | 560K ohm, ¼W, 10% | 10 | |
| R143 | 045-826 | 560K ohm, ¼W, 10% | 10 | |
| R144 | 045-826 | 560K ohm, ¼W, 10% | 10 | |
| R145 | 045-826 | 560K ohm, ¼W, 10% | 10 | |
| R146 | 045-826 | 560K ohm, ¼W, 10% | 10 | |
| R147 | 045-826 | 560K ohm, ¼W, 10% | 10 | |
| R148 | 045-766 | 22K ohm, ¼W, 10% | 10 | |
| R149 | 045-770 | 27K ohm, ¼W, 10% | 10 | |
| R150 | 045-773 | 33K ohm, ¼W, 10% | 10 | |
| R151 | 045-780 | 47K ohm, ¼W, 10% | 10 | |
| R152 | 045-784 | 56K ohm, ¼W, 10% | 10 | |
| R153 | 045-791 | 82K ohm, ¼W, 10% | 10 | |
| R154 | 045-798 | 120K ohm, ¼W, 10% | 10 | |
| R155 | 045-805 | 180K ohm, ¼W, 10% | 10 | |
| R156 | 045-815 | 330K ohm, ¼W, 10% | 10 | |
| R157 | 045-826 | 560K ohm, ¼W, 10% | 10 | |
| R159 | 048-024 | 5K ohm, Variable | 18 | UPE200RE |
| R161 | 048-030 | 1K ohm, Variable | 18 | UPE200RE |
| R162 | 045-738 | 4.7K ohm, ¼W, 10% | 10 | |
| R163 | 048-029 | 250K ohm, Variable | 18 | UPE200RE |
| R164 | 048-078 | 250K/500K ohm, S101 | 18 | C-212-A-19436-2-2-VC |
| R165 | 045-864 | 4.7M ohm, ¼W, 10% | 10 | |
| R166 | 045-836 | 1M ohm, ¼W, 10% | 10 | |
| R167 | 048-080 | 1K ohm, Variable | 18 | Series 45, Type U |
| R168 | 045-756 | 12K ohm, ¼W, 10% | 10 | |
| R169 | 045-773 | 33K ohm, ¼W, 10% | 10 | |

RESISTORS (Cont:)

| CIRCUIT REF. NO. | TEXSCAN PART NO. | DESCRIPTION | VENDOR NO. | VENDOR PART NO. |
|---|---|---|---|---|
| R170 | 045-822 | 470 ohm, ½W, 10% | 10 | |
| R171 | 045-805 | 180K ohm, ½W, 10% | 10 | |
| R201 | 045-647 | 33 ohm, ½W, 10% | 10 | |
| R202 | 045-759 | 15K ohm, ½W, 10% | 10 | |
| R203 | 045-791 | 82K ohm, ½W, 10% | 10 | |
| R204 | 045-703 | 680 ohm, ½W, 10% | 10 | |
| R205 | 045-766 | 22K ohm, ½W, 10% | 10 | |
| R206 | 045-738 | 4.7K ohm, ½W, 10% | 10 | |
| R207 | 045-738 | 4.7K ohm, ½W, 10% | 10 | |
| R208 | 048-059 | 10K ohm, w/S201 | 18 | 212-25182-1-VC |
| R209 | 048-035 | 1K ohm, Variable | 18 | 200 |
| R210 | 048-036 | 5K ohm, Variable | 18 | 200 |
| R211 | 045-766 | 22K ohm, ½W, 10% | 10 | |
| R212 | 045-749 | 8.2K ohm, ½W, 10% | 10 | |
| R213 | 045-665 | 82 ohm, ½W, 10% | 10 | |
| R301 | 045-752 | 10K ohm, ½W, 10% | 10 | |
| R302 | 045-808 | 220K ohm, ½W, 10% | 10 | |
| R303 | 045-710 | 1K ohm, ½W, 10% | 10 | |
| R304 | 045-710 | 1K ohm, ½W, 10% | 10 | |
| R305 | 048-014 | 10K ohm, Variable | 18 | UHT201 |
| R306 | 048-014 | 10K ohm, Variable | 18 | UHT201 |
| R307 | 045-668 | 100 ohm, ½W, 10% | 10 | |
| R308 | 045-808 | 220K ohm, ½W, 10% | 10 | |
| R309 | 045-710 | 1K ohm, ½W, 10% | 10 | |
| R310 | 045-710 | 1K ohm, ½W, 10% | 10 | |
| R311 | 048-014 | 10K ohm, Variable | 18 | UHT201 |
| R312 | 048-014 | 10K ohm, Variable | 18 | UHT201 |
| R313 | 045-668 | 100 ohm, ½W, 10% | 10 | |
| R314 | 045-808 | 220K ohm, ½W, 10% | 10 | |
| R315 | 045-710 | 1K ohm, ½W, 10% | 10 | |
| R316 | 045-710 | 1K ohm, ½W, 10% | 10 | |
| R317 | 048-014 | 10K ohm, Variable | 18 | UHT201 |
| R318 | 048-014 | 10K ohm, Variable | 18 | UHT201 |
| R319 | 045-668 | 100 ohm, ½W, 10% | 10 | |
| R321 | 045-808 | 220K ohm, ½W, 10% | 10 | |
| R322 | 045-710 | 1K ohm, ½W, 10% | 10 | |
| R323 | 045-710 | 1K ohm, ½W, 10% | 10 | |
| R324 | 048-014 | 10K ohm, Variable | 18 | UHT201 |
| R325 | 048-014 | 10K ohm, Variable | 18 | UHT201 |
| R326 | 045-668 | 100 ohm, ½W, 10% | 10 | |
| R327 | 045-738 | 4.7K ohm, ½W, 10% | 10 | |
| R328 | 045-808 | 220K ohm, ½W, 10% | 10 | |
| R329 | 045-689 | 330 ohm, ½W, 10% | 10 | |

RESISTORS (Cont:)

| CIRCUIT REF. NO. | TEXSCAN PART NO. | DESCRIPTION | VENDOR NO. | VENDOR PART NO. |
|---|---|---|---|---|
| R331 | 048-051 | 100K ohm, Variable | 10 | CU1041 |
| R332 | 045-808 | 220K ohm, ½W, 10% | 10 | |
| R333 | 045-686 | 270 ohm, ½W, 10% | 10 | |
| R334 | 045-752 | 10K ohm, ½W, 10% | 10 | |
| R335 | | Part of R339 assembly | | |
| R336 | 045-752 | 10K ohm, ½W, 10% | 10 | |
| R337 | 045-836 | 1M ohm, ½W, 10% | 10 | |
| R338 | 045-686 | 270 ohm, ½W, 10% | 10 | |
| R339 | 048-060 | 100K/100K/25K ohm, Variable | 18 | Type C45-2-45 |
| R341 | 046-180 | 47K ohm, ½W, 10% | 10 | |
| R342 | 045-752 | 10K ohm, ½W, 10% | 10 | |
| R343 | 045-752 | 10K ohm, ½W, 10% | 10 | |
| R401 | 045-710 | 1K ohm, ½W, 10% | 10 | |
| R402 | 045-745 | 6.8K ohm, ½W, 10% | 10 | |
| R403 | 045-668 | 100 ohm, ½W, 10% | 10 | |
| R404 | 045-703 | 680 ohm, ½W, 10% | 10 | |
| R405 | 046-051 | 39 ohm, ½W, 10% | 10 | |
| R406 | 045-612 | 4.7 ohm, ½W, 10% | 10 | |
| R407 | 045-668 | 100 ohm, ½W, 10% | 10 | |
| R408 | 045-640 | 22 ohm, ½W, 10% | 10 | |
| R409 | 045-700 | 560 ohm, ½W, 10% | 10 | |
| R410 | 045-612 | 4.7 ohm, ½W, 10% | 10 | |
| R411 | 045-682 | 220 ohm, ½W, 10% | 10 | |
| R412 | 046-056 | 51 ohm, ½W, 5% | 10 | |
| R413 | 045-640 | 22 ohm, ½W, 10% | 10 | |
| R414 | 045-668 | 100 ohm, ½W, 10% | 10 | |
| R415 | 045-738 | 4.7K ohm, ½W, 10% | 10 | |
| R416 | 045-703 | 680 ohm, ½W, 10% | 10 | |
| R417 | 045-640 | 22 ohm, ½W, 10% | 10 | |
| R418 | 046-040 | 22 ohm, ½W, 10% | 10 | |
| R419 | 045-735 | 3.9K ohm, ½W, 10% | 10 | |
| R420 | 045-612 | 4.7 ohm, ½W, 10% | 10 | |
| R421 | 045-626 | 10 ohm, ½W, 10% | 10 | |
| R422 | 045-682 | 220 ohm, ½W, 10% | 10 | |
| R423 | 045-626 | 10 ohm, ½W, 10% | 10 | |
| R424 | 045-752 | 10K ohm, ½W, 10% | 10 | |
| R425 | 045-747 | 7.5K ohm, ½W, 10% | 10 | |
| R427 | 046-386 | 270 ohm, 1W, 10% | 10 | |
| R428 | 045-626 | 10 ohm, ½W, 10% | 10 | |
| R429 | 045-640 | 22 ohm, ½W, 10% | 10 | |
| R430 | 045-612 | 4.7 ohm, ½W, 10% | 10 | |
| R431 | 045-626 | 10 ohm, ½W, 10% | 10 | |

RESISTORS (Cont:)

| CIRCUIT REF. NO. | TEXSCAN PART NO. | DESCRIPTION | VENDOR NO. | VENDOR PART NO. |
|---|---|---|---|---|
| R432 | 046-682 | 220 ohm, 2W, 10% | 10 | |
| R435 | 045-682 | 220 ohm, 2W, 10% | 10 | |
| R436 | 045-689 | 330 ohm, ½W, 10% | 10 | |
| R437 | 045-696 | 470 ohm, ½W, 10% | 10 | |
| R500 | 046-075 | 150 ohm, ½W, 10% | 10 | |
| R501 | 046-110 | 1K ohm, ½W, 10% | 10 | |
| R502 | 045-466 | 22K ohm, 1/8W, 10% | 10 | |
| R503 | 045-654 | 47 ohm, ½W, 10% | 10 | |
| R504 | 045-745 | 6.8K ohm, ½W, 10% | 10 | |
| R505 | 045-724 | 2.2K ohm, ½W, 10% | 10 | |
| R506 | 046-068 | 100 ohm, ½W, 10% | 10 | |
| R507 | 045-654 | 47 ohm, ½W, 10% | 10 | |
| R508 | 045-668 | 100 ohm, ½W, 10% | 10 | |
| R509 | 048-095 | 10K ohm, Variable | 10 | JA-4-G-132-F-103-UA |
| R510 | 046-026 | 10 ohm, ½W, 5% | 10 | |
| R512 | 045-640 | 22 ohm, ½W, 10% | 10 | |
| R551 | 045-686 | 270 ohm, ½W, 10% | 10 | |
| R552 | 045-731 | 3.3K ohm, ½W, 10% | 10 | |
| R553 | 045-752 | 10K ohm, ½W, 10% | 10 | |
| R554 | 046-068 | 100 ohm, ½W, 10% | 10 | |
| R555 | 046-068 | 100 ohm, ½W, 10% | 10 | |
| R556 | 045-689 | 330 ohm, ½W, 10% | 10 | |
| R557 | — | Factory Selected Value | 25 | |
| R558 | 046-056 | 51 ohm, ½W, 5% | 10 | |
| R602 | 047-286 | 50 ohm, 1W, 1% | 10 | |
| R603 | 045-710 | 1K ohm, ½W, 10% | 10 | |
| R604 | 045-728 | 2.7K ohm, ½W, 10% | 10 | |
| R605 | 045-710 | 1K ohm, ½W, 10% | 10 | |
| R606 | 045-728 | 2.7K ohm, ½W, 10% | 10 | |
| R607 | 045-658 | 56 ohm, ½W, 10% | 10 | |
| R608 | 045-752 | 10K ohm, ½W, 10% | 10 | |
| R609 | 045-682 | 220 ohm, ½W, 10% | 10 | |
| R610 | 045-658 | 56 ohm, ½W, 10% | 10 | |

SWITCHES

| | | | | |
|---|---|---|---|---|
| S1 | 057-016 | SPST Toggle | 24 | RS-72-FB |
| S101 | | See R164 | | |
| S102 | 057-003 | Slide Switch | 23 | G-126 |
| S103 | | See R120 | | |
| S201 | — | See R208 | | |
| S301 | 057-016 | Rocker Switch | 24 | RS-72-FB |

SWITCHES (Cont:)

| CIRCUIT REF. NO. | TEXSCAN PART NO. | DESCRIPTION | VENDOR NO. | VENDOR PART NO. |
|---|---|---|---|---|
| S302 | 057-016 | Rocker Switch | 24 | RS-72-FB |
| S303 | 057-016 | Rocker Switch | 24 | RS-72-FB |
| S304 | 057-016 | Rocker Switch | 24 | RS-72-FB |
| S305 | 057-016 | Rocker Switch | 24 | RS-72-FB |
| S306 | 057-016 | Rocker Switch | 24 | RS-72-FB |
| S307 | 057-016 | Rocker Switch | 24 | RS-72-FB |
| S308 | 057-016 | Rocker Switch | 24 | RS-72-FB |
| S601 | C200-030-02 | Switch Assembly | 25 | C200-030-02 |
| | | TRANSFORMERS | | |
| T1 | B061-009 | 6.3V/1A RMS 45-0-45/250mA 200-0-200/100mA 115/230V Primary | 35 | AM3531 |
| | | VOLTAGE REGULATORS | | |
| VR1 | 025-018 | 1N708 Z=5.6V | 26 | |
| VR2 | 025-033 | Z=7V, 5% | 13 | VR-7A |
| VR3 | 025-033 | Z=7V, 5% | 13 | VR-7A |
| VR4 | 025-018 | 1N708 Z=5.6V | 26 | |
| VR5 | 025-033 | Z=7V, 5% | 13 | VR-7A |
| VR6 | 025-033 | Z=7V, 5% | 13 | VR-7A |
| VR7 | 025-025 | Z=18V, 5% | 3 | ZA-18B |
| VR8 | 025-038 | Z=15V, 5% | 3 | ZA-15B |
| VR101 | 025-018 | 1N708 Z=5.6V | 26 | |
| VR102 | 025-038 | Z=15V, 5% | 3 | ZA-15B |
| VR201 | 025-024 | Z=28V, 5% | 13 | VR-28A |
| VR401 | 025-010 | Z=10V | 3 | ZA-10B |
| VR501 | 025-010 | Z=10V | 3 | ZA-10B |
| | | IMPEDANCES | | |
| Z601 | A200-005-01 | 50 ohm Termination | 25 | A200-005-01 |
| Z602 | A200-005-01 | 50 ohm Termination | 25 | A200-005-01 |
| Z603 | B200-200-01 | 0 - 70 db | 25 | B200-200-01 |
| Z604 | B200-200-00 | 0 - 10 db | 25 | B200-200-00 |

CAUTION:

Units hsipped from the factory are identified for operation from the proper input power source. Note the following:

(1) 230-volt rms, 50/60-Hz, single-phase power source.

A RED label marked "230V" is wrapped around the power cord within six inches (15 cm) of the polarized power plug. A RED label marked "230V" is also attached to the rear panel of the unit above the line-cord grommet.

(2) 115-volt rms, 50/60-Hz, single-phase power source.

A YELLOW label marked "115V" is wrapped around the power cord within six inches (15 cm) of the polarized power plug. A YELLOW label marked "115V" is also attached to the rear panel of the unit above the line-cord grommet.

Damage to any unit which is connected to a 230-volt power source, but which is wired internally for 115-volt operation constitutes "misuse" and is not covered by the TEXSCAN warranty. Consult the TEXSCAN instruction manual for the proper internal power-source connection if there is any question about the intended use. NOTE: The line fuse(s) must also be checked for the correct rating and type.

## CONDITIONS OF SALE

Determination of prices, terms, conditions of sale, and final acceptance of orders are made only at our plant in Indianapolis, Indiana.

All prices are F.O.B. Indianapolis, Indiana, USA.

Terms in the United States and Canada are Net 30 days if credit has been arranged.

Terms throughout the rest of the free world are arranged with Texscan's area representative.

## SERVICE AND PARTS

Repair service is available at our plant in Indianapolis, Indiana. Before returning an instrument for repair, please write to us, requesting a Returned Material Authorization. On receipt of shipping authorization, forward the instrument prepaid. Care should be taken in packing the instrument to insure protection in transit. Also, state the type and serial number of the instrument, date of purchase, and details concerning the difficulty.

Repair parts may be ordered from our home plant or through our sales representatives. When ordering repair parts, please specify the part number and description of the item, and the type and serial number of the instrument in which it is used.

## TEXSCAN RECOMMENDS FACTORY REPAIR OF RF CIRCUITS

If failure occurs in an RF section of any TEXSCAN test instrument, TEXSCAN recommends that the complete instrument be returned to the factory for repair and calibration. Replacement of an RF assembly or component may result in failure of the instrument to meet its published specifications, and failure to perform within its design capabilities. TEXSCAN Customer Service personnel are experienced in the repair and calibration of the complete line of TEXSCAN test instruments. When practical, updated improvements can be included in the repaired instrument.

## SPECIFICATION CHANGES

The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold.

## WARRANTY

Products manufactured by Texscan Corporation are warranted against defective materials and workmanship for one year from date of shipment. Any instrument or component which has been found to be defective during this one-year period will be repaired or replaced without charge except for vacuum tubes or batteries which have given normal service. No other warranty is expressed or implied.

## ORDERING INFORMATION

In the United States and Canada, please order through your local representative or directly with the factory. Your factory trained representative can supply technical data and latest price and delivery quotations.

The factory address is:

Texscan Corporation
2446 North Shadeland Avenue
Indianapolis, Indiana 46219
Phone: 317-357-8781
TWX: 810-341-3184
Cable Address: TEXSCAN

In Western Europe, please order through your local representative, who can supply technical assistance and up-to-date price and delivery information.

Complete addresses and telephone numbers of Texscan's sales representatives are listed on the outside back cover of the catalogue.

## SHIPPING INSTRUCTIONS

Unless specific instructions accompany the order, we shall use our own judgment as to the best method of shipment. Unless otherwise specified, normal shipments will be by air freight or air express. Small items are sent via parcel post. The listed price for our products include the packing, but does not include the cost of shipping.

IMPORTANT!

## WARRANTY AND SERVICE INFORMATION

Products manufactured by TEXSCAN CORPORATION are warranted, to the original purchaser, against defective material and workmanship for a period of one year from the original date of shipment from our plant. This warranty is limited to the replacement or repair of components or parts found defective within this one-year period, including the labor involved in their replacement, when the product is returned, shipping charges prepaid, to our factory in Indianapolis, Indiana. It does not apply to normal service items, such as batteries, tubes or appearance items which have given normal service; nor does it apply to damage caused by abuse, misuse, mishandling, or damage caused by shipment, unauthorized modification, repair, or attempted repair. In fulfilling this warranty, TEXSCAN'S liability is limited to the repair of this product. The company assumes no liability for any consequential damage.

In the event that you experience difficulty with this unit, please write Customer Service Dept., TEXSCAN CORP., 2446 N. Shadeland Ave., Indianapolis, Indiana 46219, or call (317)357-8781. If return of this unit to TEXSCAN is authorized, you will be given a Repair Authorization number, which must be marked on the outside of the shipping container. Enclose the additional information requested below and forward the unit, shipping charges prepaid, to TEXSCAN. All service work is FOB our plant in Indianapolis, Indiana.

Overseas customers should contact our local sales representatives.

Service is also available, at nominal cost, for older TEXSCAN products. Please follow the same procedure described in the preceding paragraph, even though you are requesting non-warranty repairs. Not only will you help expedite the unit to Customer Service, but you will also have established your priority.

All units handled by our Customer Service Dept. are carefully re-inspected by our Quality Assurance Dept. to ensure that they function in accordance with the specifications which were applicable at the time of their manufacture. We reserve the right to make product improvements and changes, without incurring any liability to modify equipment previously sold. However, we do occasionally find it more expedient to update portions of older models rather than attempt repairs.

Should you desire to perform repairs in your own facility, approved replacement parts may be purchased through our Customer Service Dept. Please order by TEXSCAN part number and specify the model and serial number of the instrument in which it is to be used.

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REPAIR AUTHORIZATION NO._____ DATE_____ YOUR P.O.NO._____

TYPE OF EQUIPMENT_____ MODEL_____

SERIAL NUMBER_____ DATE OF PURCHASE_____

OWNER'S NAME & ADDRESS_____

FOR FURTHER INFO, CONTACT_____

DESCRIPTION OF PROBLEM_____

_____

_____